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Lubrication Considerations in Gear Design

To Promote Proper Lubrication and Hence Long Life, the Designer Must Choose the Correct Type of Gear for a Particular Application and Must Consider the Effect of Its Speed and Tooth Loading on Its Film-Forming Ability — Prepared by the Technical Division Industrial, Socony-Vacuum Oil Co., Inc.

GEARS will not operate satisfactorily unless a sufficient amount of lubrication is maintained between the surfaces of the meshing teeth. The very nature of gearing requires that provision for lubrication be considered early in the design stage. Power cannot be transmitted efficiently, nor the life of the gears extended to the economic maximum, if direct metallic contact of meshing gear teeth is permitted to absorb useful power and cause rapid tooth wear or early surface fatigue failure. On the other hand, even a combination of the correct gear design and a lubricant of the correct type does not guarantee that operation will be trouble-free, because some gears are inherently difficult to lubricate—the teeth may vary in hardness, degree of finish, and alignment—and the actual service conditions may be different from the assumed design service conditions.

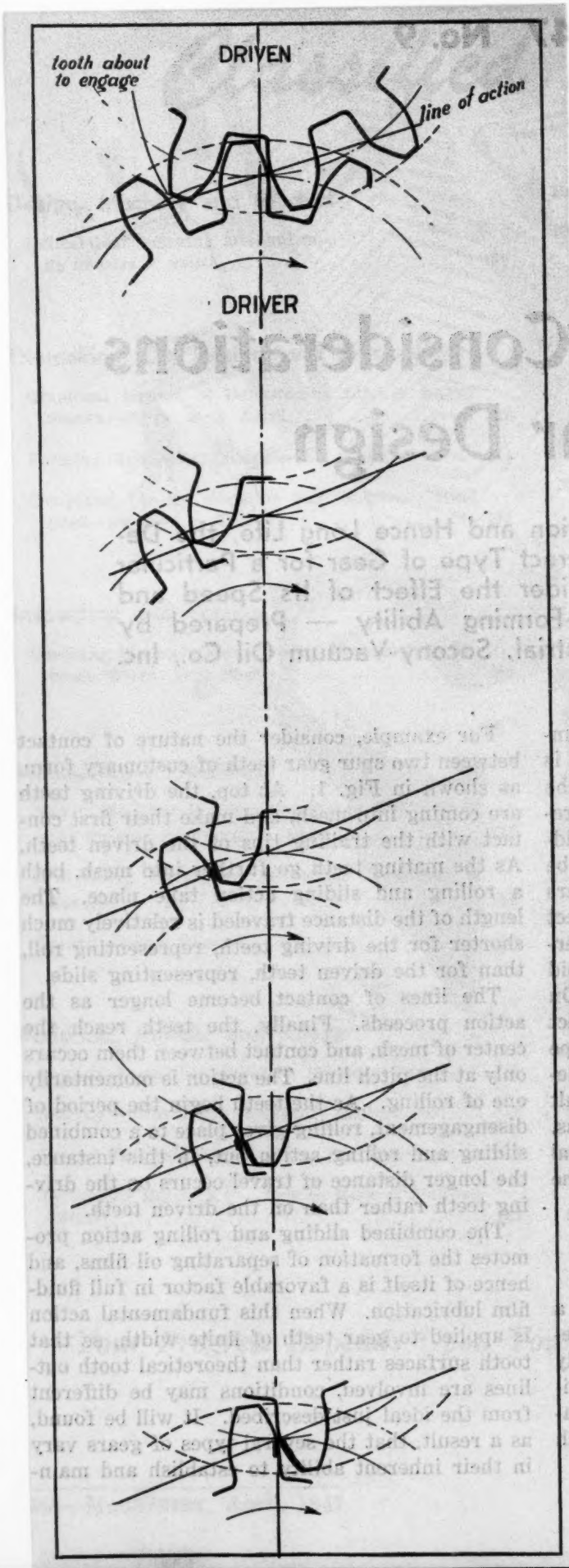
Film-Forming Ability

Like bearings, gears may be lubricated by a full film of oil that is drawn into the space between contacting surfaces, or by an extremely thin film of oil under so-called boundary lubrication conditions. The type of contact and relative motion between mating teeth decide which of these conditions exists.

For example, consider the nature of contact between two spur gear teeth of customary form, as shown in Fig. 1. At top, the driving teeth are coming into mesh, and make their first contact with the trailing tips of the driven teeth. As the mating teeth go further into mesh, both a rolling and sliding action take place. The length of the distance traveled is relatively much shorter for the driving teeth, representing roll, than for the driven teeth, representing slide.

The lines of contact become longer as the action proceeds. Finally, the teeth reach the center of mesh, and contact between them occurs only at the pitch line. The action is momentarily one of rolling. As the teeth begin the period of disengagement, rolling gives place to a combined sliding and rolling action but, in this instance, the longer distance of travel occurs on the driving teeth rather than on the driven teeth.

The combined sliding and rolling action promotes the formation of separating oil films, and hence of itself is a favorable factor in full fluid-film lubrication. When this fundamental action is applied to gear teeth of finite width, so that tooth surfaces rather than theoretical tooth outlines are involved, conditions may be different from the ideal just described. It will be found, as a result, that the several types of gears vary in their inherent ability to establish and main-



tain the substantial film of lubricant that is desirable for the most effective lubrication; this is shown by Tables 1 and 2.

The action of the mating gears shown in Table 1 produces a situation that is illustrated by Fig. 2. The line of tooth contact is perpendicular, or almost so, to the direction of the film-forming action, so that oil introduced into the teeth as they start engagement is drawn positively between them, tending to form a separating film of substantial thickness and to prevent direct metallic contact. There is then no reason for film rupture or failure as far as the type of gear is concerned. However, boundary lubrication may be encountered when unit loadings increase sufficiently to rupture the oil film, or when the speed is so low as to hinder or prevent an ample flow of oil to the active tooth areas.

In the gears shown in Table 2, point contact or marked side-slide is present, and these conditions are not favorable to full fluid-film lubrication. Boundary lubrication is usually the best that can be attained.

Because of the difficult lubrication conditions inherent in helical gears operating on crossed shafts, including non-throated worm-gears, such gears are customarily designed to handle low tooth loadings. Even then, lubrication will be of the boundary type, and unless the correct oils are used, it is doubtful if even boundary conditions can be maintained sufficiently to avoid excessive tooth wear.

The difficult conditions present in single-throated worm-gears are partially overcome by making the gear itself of friction-reducing bronze. This, together with the fact that several teeth are in contact sim-

Fig. 1. Contact between Meshing Gear Teeth is a Combination of Rolling and Sliding. During the Period of Engagement, the Length of the Distance Traveled (Shown by Heavy Line) is Greater for the Driven than for the Driving Gear; the Reverse is True as the Teeth Leave the Center of Mesh to Start the Period of Disengagement. The Rolling and Sliding Action Promotes the Formation and Maintenance of Separating Oil Films

ultaneously, helps to overcome the difficult conditions. Elastic deformation of bronze tooth surfaces increases the contact area and reduces unit pressures.

The use of hypoid gears for industrial purposes need not be accompanied by lubrication difficulties. In contrast with automotive practice, space for accommodation of the hypoid gear set is ordinarily not unduly restricted. Consequently the gears can be made relatively large, with reasonable unit loadings, in order to eliminate the extremely high pressures that tend to force even the strongest, most adhesive oils out of the spaces between mating teeth. A correctly designed hypoid gear for industrial use should be considerably less difficult to lubricate than a single-throated worm-gear, but somewhat more difficult than a spiral bevel gear.

Summing up then, it is found that of the gear types in widest use, spur gears, helical gears on parallel shafts, herringbone gears, bevel gears, and spiral bevel gears are inherently favorable to the establishment and maintenance of full fluid films. Double-throated worm-gears, in light of all present knowledge concerning them, are also apparently favorable to lubrication. Helical gears on crossed shafts and non-throated worm-gears are difficult to lubricate, especially if they are heavily loaded. Single-throated worm-gears and hypoid gears with considerable shaft offset are not favorable to full fluid-film lubrication, and boundary lubrication conditions will ordinarily prevail.

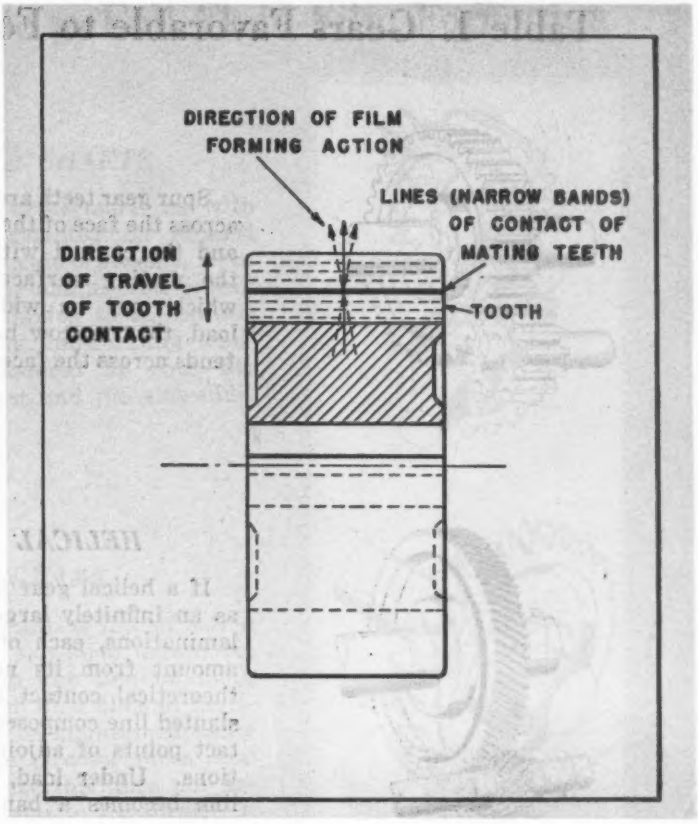


Fig. 2. The Gears Shown in Table 1 are Favorable to the Formation and Maintenance of Full Fluid-lubricant Films between Meshing Teeth because They Satisfy Conditions Shown Here. The Direction of the Film-forming Action is Perpendicular, or Almost so, to the Line of Contact between Meshing Teeth

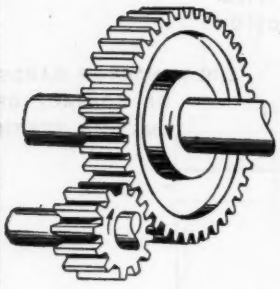
Obviously, inherent capacity for easy or sufficient lubrication is not the sole criterion in the selection of a gear type. The designer has to consider other factors as well, such as available space, quiet operation, permissible tooth loading, load distribution over more than one tooth, angularity between driving and driven shafts, and speed ratio—all of which affect the choice of gear.

In addition, the designer has a direct, although perhaps limited interest in manufacturing processes and control. Gear steels should be specified that are of known quality and are produced with close control over composition and uniformity. His interest should extend as well to consideration of the uniform reaction of the material to forging, machining, and heat-treating operations. Uniformity of raw materials and manufacture contributes to uniformity of product, a prime requisite in successful gear operation.

Designed tooth loadings may be exceeded in operation because of variations in surface smoothness and hardness or because of tooth misalignment. Unit pressures may become so high that oil films are punctured or entirely squeezed away, and harmful metallic contact results. Also, when surface smoothness and hardness are not uniform, pitting is likely to occur; such pitting may grow progressively worse when conditions are severe and cannot be prevented even by the use of a correct, high-quality lubricant.

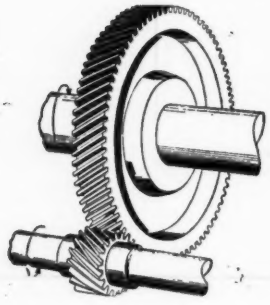
A higher degree of surface finish on the gear

Table 1. Gears Favorable to Formation of Full Fluid Film



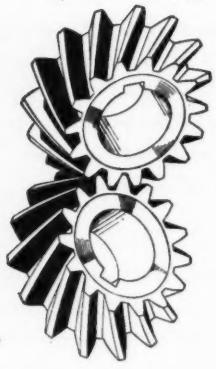
SPUR GEARS

Spur gear teeth are cut straight across the face of the gear blanks, and the contact with respect to the mating surfaces is a line which may be widened, under load, to a narrow band that extends across the face of the teeth. This line of contact, being at right angles to the film-forming action, sweeps oil into the pressure area and is responsible for the ability of spur gears to maintain fluid films of oil between contacting surfaces.



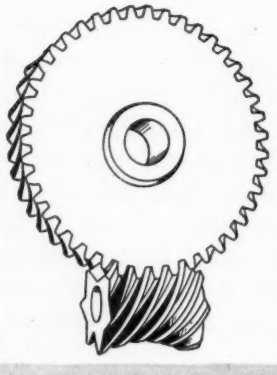
HELICAL GEARS ON PARALLEL SHAFTS

If a helical gear is considered as an infinitely large number of laminations, each offset a small amount from its neighbor, the theoretical contact is a curved, slanted line composed of the contact points of adjoining laminations. Under load, this slanted line becomes a band extending across the face of the gear teeth, which is so nearly perpendicular to the line of film formation that helical gears on parallel shafts are favorable to full fluid-film lubrication. This also applies to herringbone gears, as the individual gear is basically two helical gears on the same gear blank.



BEVEL AND SPIRAL BEVEL GEARS

Since the action of the teeth of bevel gears is like that of spur gears, they also are favorable to full fluid-film lubrication. A spiral bevel gear can be regarded as a bevel gear whose teeth have been twisted to form a spiral. The line of tooth contact is nearly perpendicular to the line of oil-film formation and this creates a condition favorable to fluid-film formation.



DOUBLE-THROATED WORM-GEARS

In this relatively new development in gearing there is no rolling action between mating gear teeth; the action is one of sliding only. Moreover, the teeth appear to make band contact radially. This, together with the fact that the construction causes several teeth of the worm and gear to be in mesh at any instant, suggests that this type of gear should be favorable to good film formation. While the entire subject of double-throated worm-gears is still under considerable investigation, experience to date indicates that effective lubrication is possible.

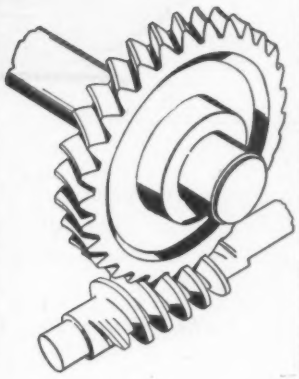
Table 2. Gears Less Favorable to Full Fluid-Film Formation

HELICAL GEARS ON CROSSED SHAFTS

When mating helical gears operate on crossed instead of parallel shafts, the theoretical contact is always a point. While the point may be enlarged to a small circular area by deformation of the metal under load, the pressure is nevertheless high during contact. Furthermore, as with all gears mounted on crossed shafts, side-slide is present. Even though basic sliding and rolling take place during tooth contact, the resulting film-forming tendency is hindered by both the point contact and the side-slide.

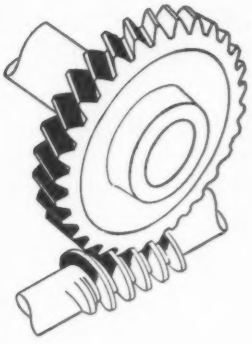
SINGLE-THROATED WORM-GEARS

In a single-throated worm-gear, tooth contact is on a curved line. The sliding and rolling action of the gear teeth is radial, as in spur gears, but the rotation of the worm imposes side-sliding, and because the speed of the worm is high compared to that of the gear, side-slide predominates. The resulting line of action of the net side-slide almost coincides with the line of tooth contact. Full fluid films of lubricant cannot be maintained easily under these circumstances, and conditions are therefore not entirely favorable to the formation of full fluid films.



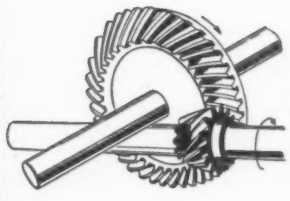
NON-THROATED WORM-GEARS

The teeth of a non-throated worm-gear are cut angularly across the face of a blank. They are not curved and do not envelop the teeth of the worm. Also, since they are a form of helical gears mounted on crossed shafts, point contact prevails, the contact pressure in relatively high, and side-slide is present; hence these gears are not favorable to lubrication.



HYPOID GEARS

The line of contact between mating teeth of hypoid gears is a curved, slanted line, somewhat like that found with spiral bevel gears. When the shafts of pinion and gear are only slightly offset, conditions are similar to those prevailing with spiral bevel gears, and hence are favorable to lubrication. As the amount of offset increases, side-slide progressively assumes greater importance and the lubrication problem becomes more difficult.



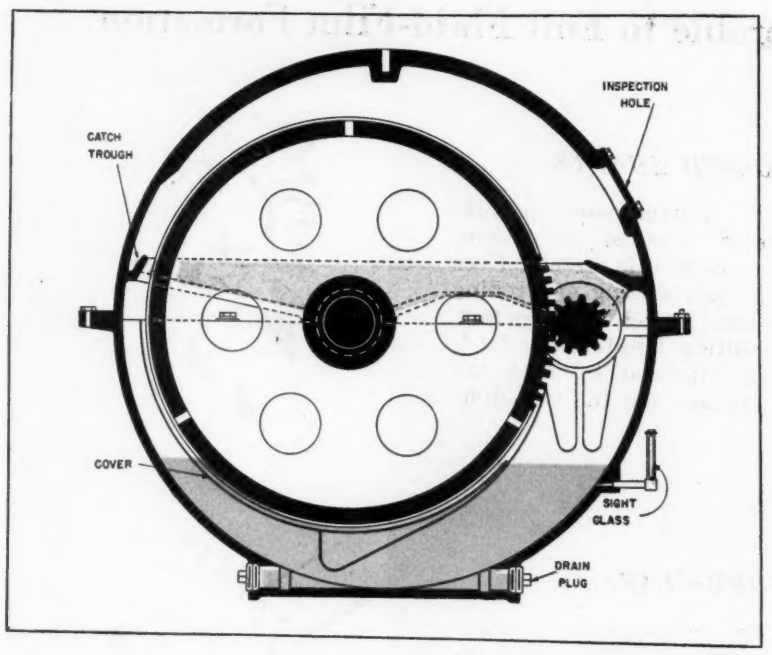


Fig. 3. With This Method of Lubrication, the Main Supply of Oil is Kept Relatively Free of Agitation and Churning. The Lower Half of the Gear is Encased by a Metal Cover, into which Oil from the Reservoir Enters through Suitable Holes. The Rotation of the Gear Carries the Oil Upward and Throws it against the Upper Half-casing, where it is Cooled by Radiation. The Oil Thrown by the Gear is Caught in Troughs on the Inside of the Upper Casing, and is Fed by Gravity to the Bearings. Drain Holes in the Bearing Seats Return the Oil to the Reservoir

teeth may be necessary. Pronounced surface irregularities cut through oil films and cause galling of the surface metal.

Lubricating the Gear Set

To be of practical use, a gear must be supported on a shaft, which in turn is carried in some form of bearings. This suggests also the use of a housing or support for the bearings. The latter may be very elementary or may be developed into a more or less elaborate structure, entirely enclosing the gears and acting at the same time as a sump or reservoir for holding the gear lubricant.

The design of shafts, bearings, and bearing supports or housings is a matter of the utmost importance. They must be developed along with the gear design itself, or else the gear set is likely to be improperly lubricated.

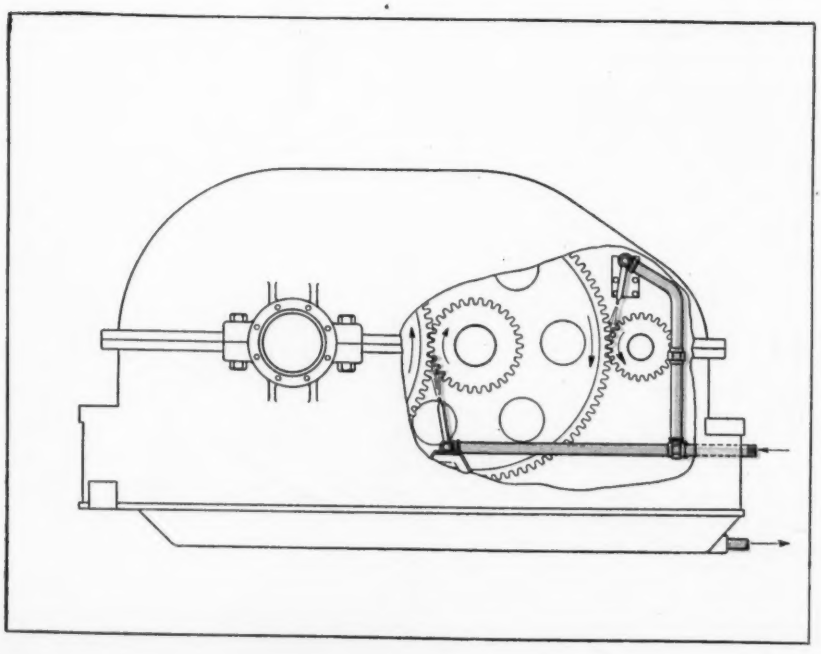


Fig. 4. In Forced-circulation Oiling Systems Such as This, it is Important that the Spray of Oil be Directed at the Teeth Just as They Start Engagement

With enclosed gearing, it is incumbent on the designer to carefully assess the heat generated during operation and provide a sufficient heat transfer surface in the gear-case or oil-cooler to maintain moderate operating temperatures. Lubricating oil that becomes excessively thinned due to high temperatures is more easily squeezed from between the teeth, and metal-to-metal contact results. Ignoring any heat rise due to external causes, the total amount of heat generated is in practically direct proportion to the horsepower transmitted, whereas the physical size of the gear set is increased at a lesser ratio. Hence, the total natural radiation from a large case is relatively of less magnitude than from a small case, and means of forced cooling of the lubricating oil may have to be provided for the larger unit.

The exact nature of the proposed lubricating system also requires consideration. When splash or bath lubrication is used, the normal oil level must be carefully determined. If the oil level is too high, unnecessary churning of the lubricant brings about high temperatures, which thin the oil excessively and accelerate oxidation. This condition is encountered frequently in small, high-speed sets, and indicates that the design should provide for the correct oil level and for the optimum radiating capacity of the gear housing or casing. On the other hand, large splash-oiled gear sets may also subject the lubricant to excessive churning. This condition can be avoided by encasing the lower half of the gear in a metal cover having holes which admit oil in limited quantity from the main supply. The gear dips into a relatively small quantity of oil, and the main supply is kept free of agitation and churning. This is illustrated in Fig. 3.

With splash lubrication, it is also wise to provide a settling or sediment chamber by damming or baffling off that part of the oil reservoir where the bulk of the oil drops back to the main supply. The oil in such a reservoir lies comparatively still and solid impurities settle to the bottom; the relatively clean oil then flows slowly over the dam to the main body of lubricant. Magnetic drain plugs at strategic points in the gear-case assist in removing iron and steel particles whose continued presence would cause wear by abrasion, or perhaps would accelerate oxidation of the lubricant by catalytic action.

Circulation oiling, with the lubricant sprayed on the gears (as illustrated in Figs. 4 and 5), encourages radiation of heat from the oil to the air, and normally eliminates the heat developed due to churning of the oil in a bath or splash system. Part of the spray strikes the sides of the case and is cooled as a result. In a circulation system, cooling by a separate oil cooler is more easily arranged. Such a system also permits the use of oil filters, a practice that assists lubrication by removing harmful abrasives and sludge from the lubricating oil.

The point of application of oil to the meshing

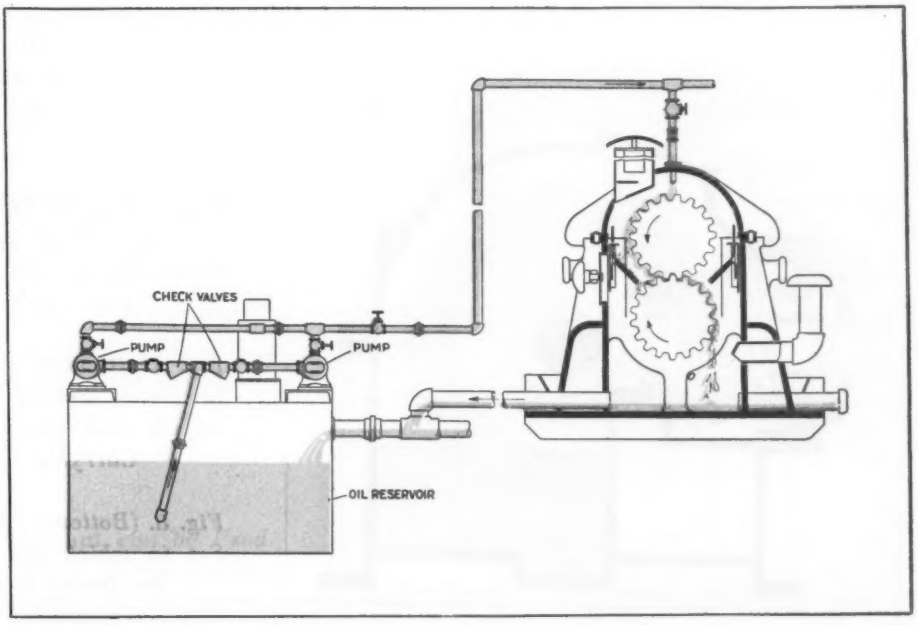
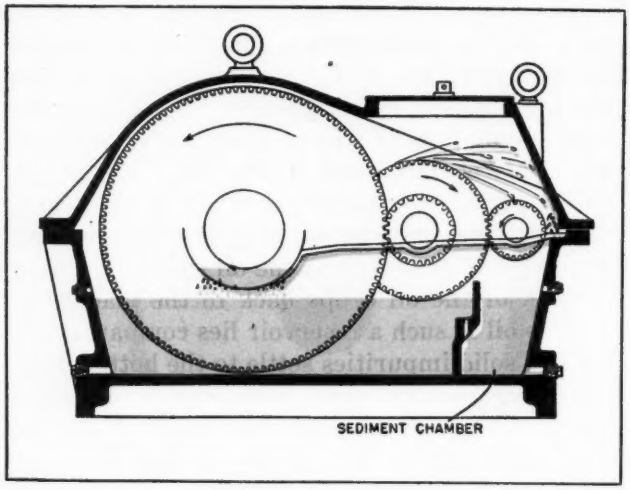
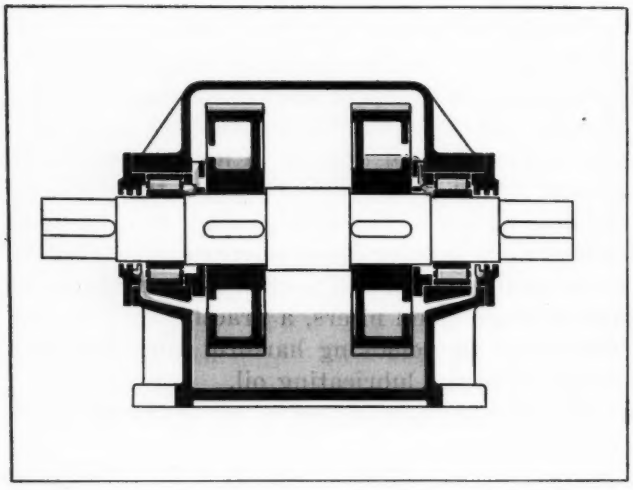
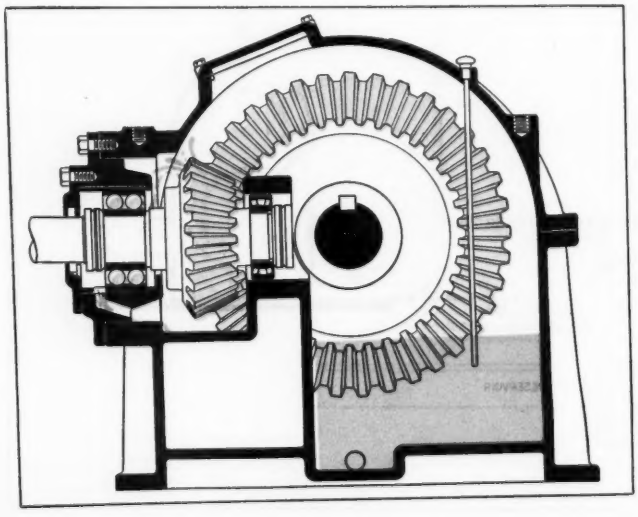


Fig. 5. Because the Gears of This Pinion-stand Operate in Either Direction, Provision is Made to Feed Oil to Both Sides of the Meshing Teeth. Oil, Pumped from a Reservoir, is Flooded over the Upper Gear. Due to the Rotation of the Gear, the Oil is Diverted to a Baffle Plate, which in Turn Guides it to the Incoming Teeth of the Lower Gear. Thus, Irrespective of Direction of Rotation, Oil is Fed to the Teeth of Both Gears on the Approaching Side of Mesh







teeth is very important in forced-circulation systems. In general the spray of oil should be directed at the teeth just as they start engagement, as shown in Fig. 4. Likewise, if the gears are required to operate in either direction, spray provisions must be made for both conditions. Frequently, deflecting troughs or baffles will accomplish the same purpose, as in the pinion-stand shown in Fig. 5.

Breather openings or vents should be provided for enclosed gear sets. Any build-up in pressure that tends to cause leakage outward will thus be avoided. Venting also helps cool the gear-case and assists in the removal of potentially harmful water vapor. A means of venting is almost imperative when a gear set is expected to operate on an intermittent basis, as the alternate heating and cooling are favorable to the accumulation of moisture by condensation of airborne water vapor. Any water that accumulates in the gear-case will tend to cause rusting of the gears and interior of the housing and the formation of emulsions and sludges—conditions that must be avoided as much as possible in the interests of gear and lubricant life.

Bearings usually are lubricated by the same oil that is used for the gears themselves. This is a relatively simple procedure when circulation by pump or gravity means is utilized. In splash-lubricated sets, part of the oil thrown from the gear is led to the bearings. Troughs, pockets in the gears, and direct splash from the gears are common methods by which bearings are lubricated, as shown in Figs. 6, 7, and 8.

There is little the designer can do for the lubrication of open gearing other than to design the gears for the load, speed ratio, and any other

Fig. 6. (Top) In This Double-reduction Splash-lubricated Gear Set, Oil Splashed from the Gears Drains into a Trough in the Housing and Thence to the Bearings

Fig. 7. (Center) Splash-lubricated Gear Set in which Pockets are Cast in the Gears on the Low-speed Shaft for the Purpose of Carrying Oil to the Bearings

Fig. 8. (Bottom) Splash-lubricated Bevel-gear Set in which the Bearings are Lubricated by Direct Splash from the Gears

requirements involved, and supply adequate supports in the form of shafting and bearings. He can, however, specify the installation of a mechanical force-feed lubricator or a simple drop-feed oil-cup that will permit the application of small but regular feeds of a lubricant having characteristics valuable in boundary film lubrication. The force-feed lubricator, because of its positive action, is to be preferred if a suitable mounting and drive can be arranged.

The problem of gear lubrication resolves into one of lubricant selection and intelligent maintenance of gears and lubricating oil. Fortunately, oil refiners are keenly aware of the lubrication needs of modern gearing of both the enclosed and open types. They have available a variety of proved lubricants and lubrication engineers who are qualified by training and experience to consult with the gear user and advise him on lubricant selection and maintenance.

Improvised Super-Cooling Unit

SMALL tool-rooms or heat-treating shops where the amount of work to be cooled to below zero temperatures is an occasional rather than a production job can improvise a small economical super-cooling unit such as shown in the illustration.

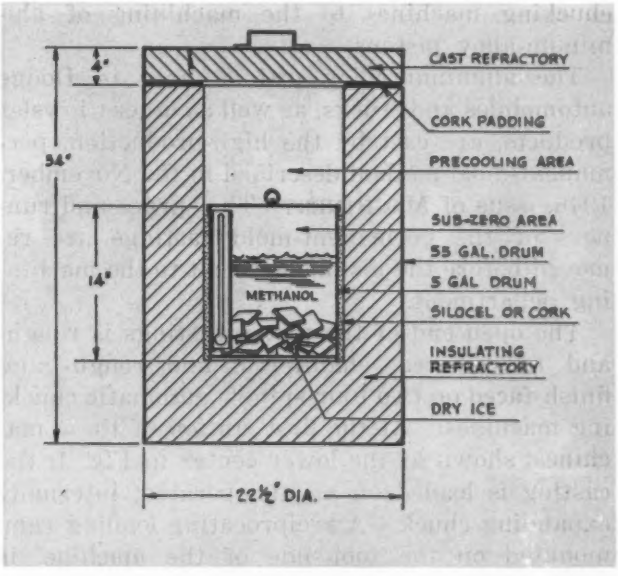
This unit, which can be easily built from materials available in most shops, was described in a recent issue of *Heat Treating Hints*, published by the Lindberg Engineering Co. The unit was constructed by cutting a 4-inch high section from the top of an empty 55-gallon oil drum. The bottom of this drum was lined with insulating refractory, and the openings between the insulating bricks were filled with powdered silocel. The remainder of the inside wall of the drum was also lined with insulating refractory brick.

An empty 5-gallon container was then placed in the cooling chamber. The space between this container and the brick wall was packed with silocel, leaving a clearance for the snap-lid on containers of this type. This drum occupies only the lower portion of the cooling chamber, which provides a pre-cooling area immediately above.

The sheet-metal ring that was cut from the top of the 55-gallon oil drum was then filled with cast refractory cement. Insulating brick and cement can also be used to fill in this ring to make a solid cover for the unit. Lifting handles were fastened to the top of the cover to facilitate removal. A cork pad ring was provided on the under side of the cover to insure a close fit between the cover and the top of the unit.

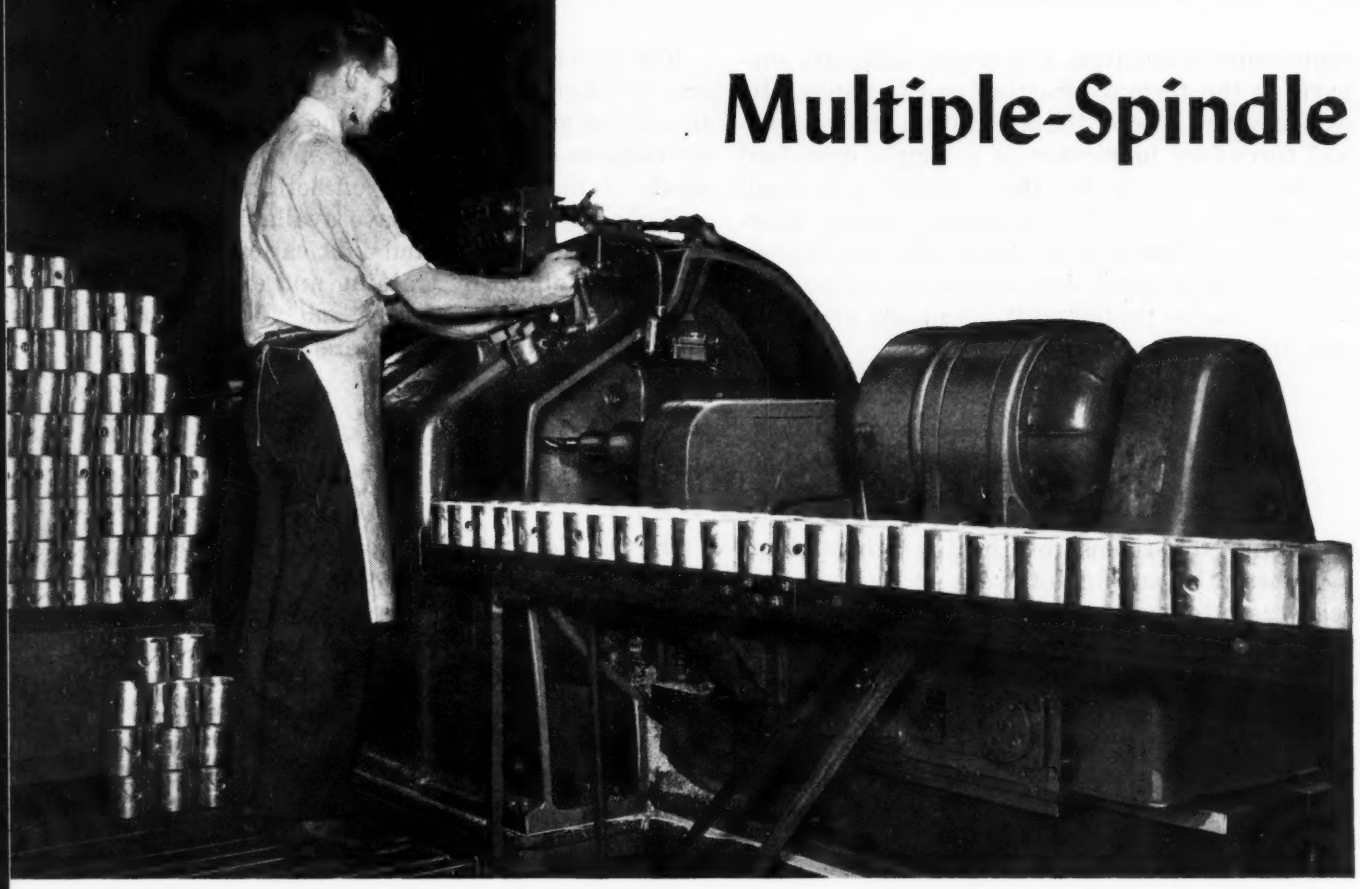
Dry ice alone, or in combination with absolute methyl alcohol or methanol, can be used in the inner container as the refrigerant. Even though the temperature of dry ice is approximately minus 110 degrees F., it is impossible to obtain temperatures less than minus 70 degrees F. in a unit of this type unless alcohol is used. The alcohol can be used in various proportions with dry ice to obtain temperatures as low as minus 97 degrees F. without solidifying the alcohol. This temperature is low enough for most sub-zero refrigerating operations.

If dry ice is used alone, the parts to be cold-treated are usually wrapped in waxed paper prior to placing them in the container. If alcohol is used in conjunction with the dry ice, the parts are placed in a basket before immersion into the alcohol in the container.



Improvised Super-cooling Unit that can be Used for the Cold-treatment of Work by Subjecting it to Temperatures as Low as Minus 97 Degrees F.

Multiple-Spindle



PISTONS for from 1500 to 1800 automobiles a day, representing a production of from 9000 to 10,800 pistons, are currently being finished at the Dodge Division of the Chrysler Corporation on twenty-eight machines. One of the features of this post-war production line is the adaptation of 4- and 6-spindle automatic chucking machines to the machining of aluminum-alloy pistons.

The aluminum-alloy pistons used in Dodge automobiles and trucks, as well as other Chrysler products, are cast by the high-production, permanent-mold method described in the November, 1946, issue of MACHINERY. The sprues and runners of the permanent-mold castings are removed before the pistons are sent to the machining department.

The open end of the piston castings is rough- and finish-bored, chamfered, and rough- and finish-faced on two four-spindle automatic chucking machines. At the first station of these machines, shown at the lower center in Fig. 1, the casting is loaded on an air-operated, internally expanding chuck. A reciprocating loading ram, mounted on the tool-slide of the machine, is manually advanced to position the piston, thus insuring proper mounting of the part on the stub arbor of the chuck. The bore of the piston is firmly gripped and accurately located for the subsequent machining operations by two sets of four pins each. One set of pins is applied to the bore immediately beneath the dome of the piston and the other set near the skirt end of the piston. The pins, or fingers, have serrated outer ends, and each set is independently expanded against the piston bore by the cam surfaces of a cylindrical plunger in the center of the arbor.

The headstock of the machine is indexed counter-clockwise, moving the piston through an angle of 90 degrees to Station 2. Here the bore and face of the open end of the piston are rough-turned. A tungsten carbide-tipped, rough-facing tool, mounted on the front cross-slide of the machine is fed transversely at 0.006 inch per revolution. The rough-boring, tungsten carbide-tipped tool, mounted on the tool-slide at this station, is fed longitudinally into the open end of the piston at 0.0077 inch per revolution.

At Station 3, shown at the bottom of Fig. 2, the face is finish-turned and a 30-degree chamfer

Automatics Speed Up Dodge Piston Production

Unusual Tooling on Multiple-Spindle, Automatic Chucking Machines and Drilling and Boring Machines is a Feature of the Equipment Used in Rapidly Finishing Aluminum-Alloy Pistons at the Dodge Division of Chrysler Corporation

By CHARLES H. WICK

is machined between the face and bore surfaces. The tungsten carbide-tipped, finish-facing tool, mounted on the lower rear cross-slide of the machine, is fed transversely at 0.0045 inch per revolution. The chamfering tool is advanced horizontally with the tool-slide at 0.0077 inch per revolution.

The piston is then indexed to Station 4, shown at the top in Fig. 2, where the bore is finish-turned to from 3.118 to 3.120 inches in diameter, by 5/32 inch deep. The tungsten carbide-tipped finish-boring tool bit, mounted on the tool-slide, is fed longitudinally at the rate of 0.0021 inch per revolution.

The four spindles of these machines are rotated at 703 R.P.M., corresponding to a surface speed of 610 feet per minute on facing cuts and 575 feet per minute on boring cuts. It requires 42.1 revolutions to finish a piece, and the headstock indexes 450 times per hour. Cams for the tool-slide are so designed that they feed the tools longitudinally at 0.0077 inch per revolution for 34.4 revolutions and at 0.0021 inch per revolution for 7.7 revolutions.

The wrist-pin holes of the piston are then machined on two duplex, horizontal drilling and boring machines, one of which is shown in the heading illustration. Each of these two-way, six-station machines has two hydraulic units equipped with multiple heads, and one hydraulic unit with a two-spindle head for accelerated line reaming. The left-hand head of the machines is

Fig. 1. Cast Aluminum-alloy Pistons are Loaded on an Air-operated Expanding Chuck at the First Station on This Four-spindle Chucking Machine

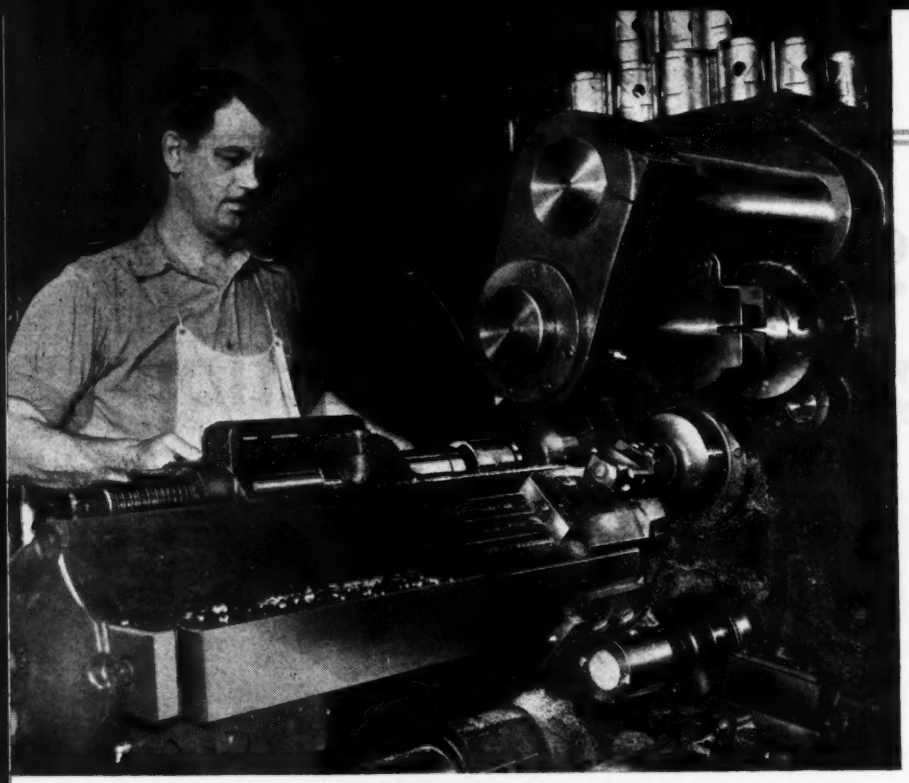


Fig. 2. Rear Tooling at Stations 3 and 4 of the Automatic Machine Shown in Fig. 1. Piston has been Removed from Spindle in Fourth Station to Show the Arbor

equipped with ten spindles, and the right-hand head with eight spindles.

At the first station, two parts are loaded and unloaded, as shown in Fig. 3. These parts are indexed through 60 degrees to the second station, where the wrist-pin holes in both sides of each piston are core-drilled by two drills mounted in the left-hand head and two in the right-hand head. These 13/16-inch diameter, three-flute, standard core-drills are rotated at 940 R.P.M., or 200 surface feet per minute, and are hydraulically fed at 0.008 inch per revolution.

The outer ends of the wrist-pin holes are chamfered at Station 3 by means of special four-flute core-drills, 1.250 inches in diameter, having a 45-degree chamfer and a flat nose. These four drills are turned at 765 R.P.M., or 200 surface feet per minute. The wrist-pin holes are rough-reamed from both sides at Station 4 by 0.847-inch diameter, high-speed steel reamers. These reamers are turned at 560 R.P.M. and fed at 0.005 inch per revolution. The recesses in both ends of the wrist-pin holes, for the wrist-pin retaining rings, are grooved at Station 5. Four eccentric recessing tools, turning at 200 surface feet per minute, are employed for this operation.

At the sixth and final station, two 0.8537-inch diameter reamers are fed at 0.0025 inch per revolution from the left-hand head only, to semi-finish line ream the wrist-pin holes in the two pistons. The reamers are turned at 125 surface feet per minute. In reaming both of the wrist-pin holes by feeding the tool from only one side, any misalignment from previous double-end operations is corrected. Tooling at one end of these two-way machines is shown in Fig. 4. Following these operations, the pistons are placed on a roller conveyor and pass through an automatic jet washer to remove chips which might interfere with positioning them in the subsequent operation.

The pistons are then transferred to two six-spindle chucking machines. Each of the six spindles are rotated at 970 R.P.M., or 840 surface feet per minute. It requires 136 revolutions to complete a piece, result-

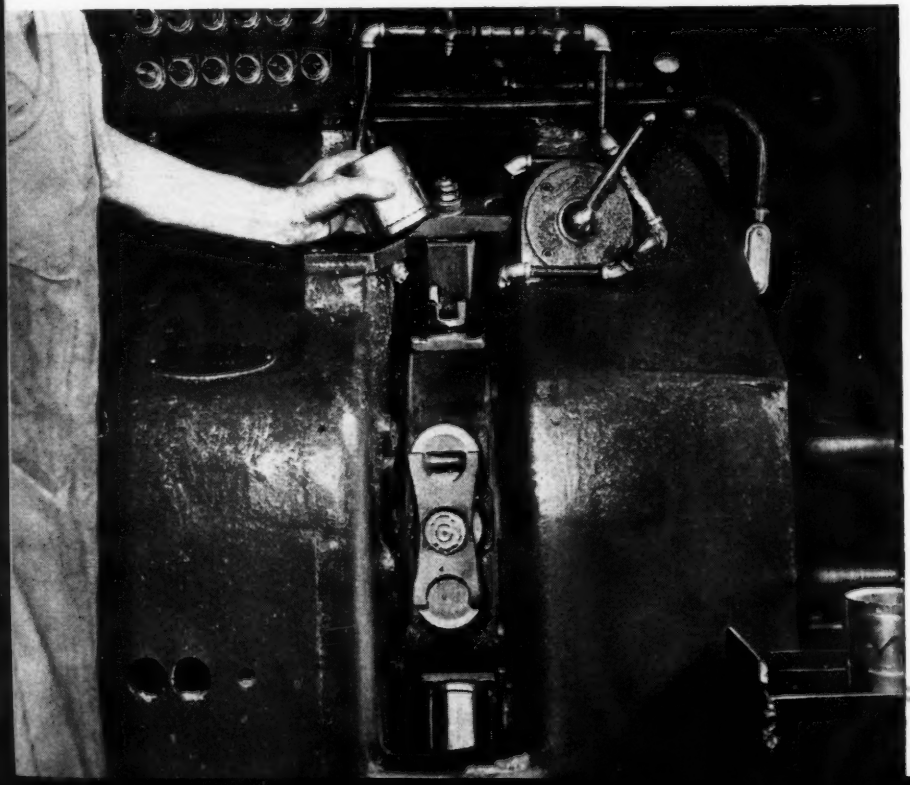


Fig. 3. Two Pistons are Held at Each of the Six Stations on This Duplex, Horizontal Drilling and Boring Machine for Semi-finishing the Wrist-pin Holes

Fig. 4. Tooling at One End of the Two-way Machine Shown in Fig. 3 and in the Heading Illustration. Twist Drills, Reamers, and Recessing Tools are Hydraulically Fed

ing in a machine cycle of 11.7 seconds per piece, or a gross production of 308 pistons per machine per hour.

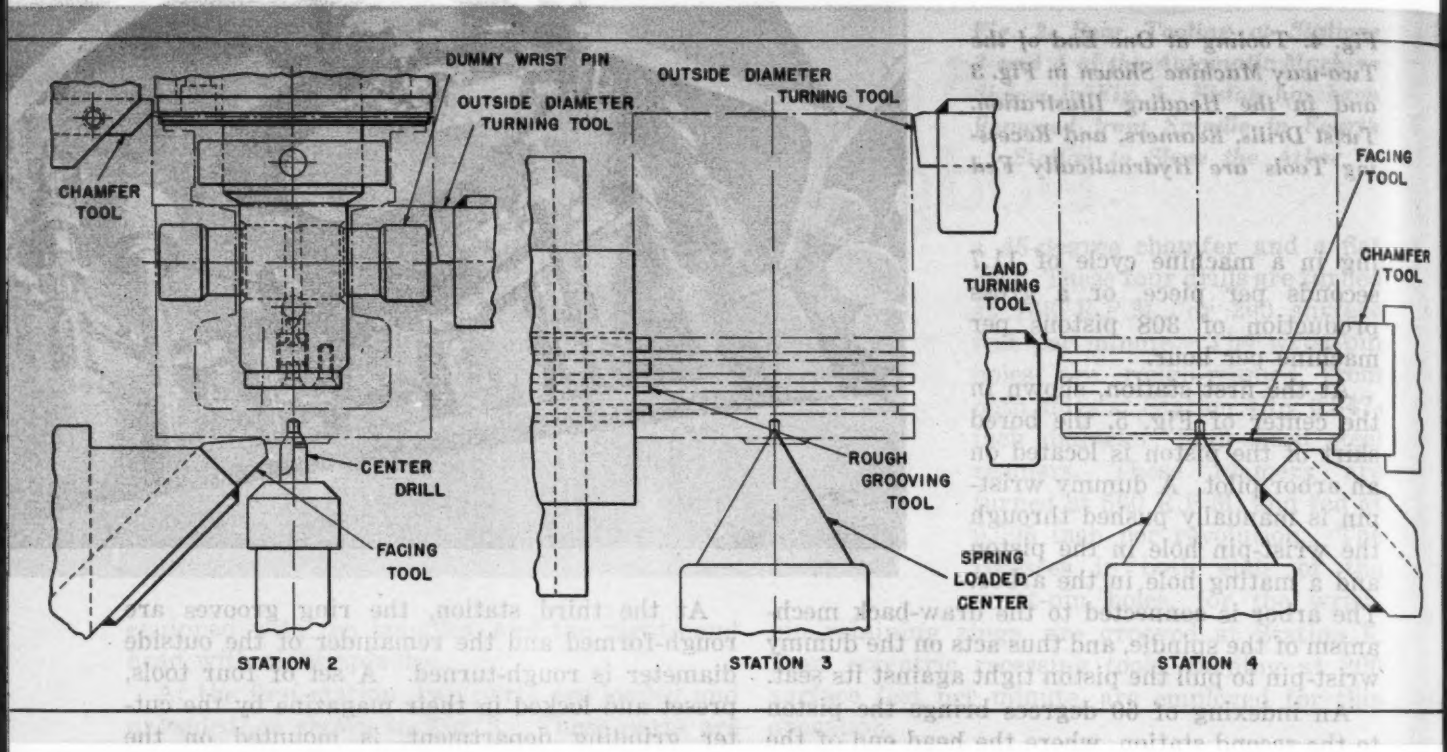
At the first station, shown in the center of Fig. 5, the bored skirt of the piston is located on an arbor pilot. A dummy wrist-pin is manually pushed through the wrist-pin hole in the piston and a mating hole in the arbor. The arbor is connected to the draw-back mechanism of the spindle, and thus acts on the dummy wrist-pin to pull the piston tight against its seat.

An indexing of 60 degrees brings the piston to the second station, where the head end of the piston is rough-faced, the outside diameter is rough-turned part way, the head end is center-drilled, and a chamfer is machined on the outside diameter of the skirt end. A tungsten carbide-tipped facing tool, mounted on the cross-slide at this station, is used to rough-face the head end. This tool is fed at 0.0136 inch per revolution for 86 revolutions and at 0.004 inch per revolution for 50 revolutions, because of the diminishing diameter that it is cutting. An air-operated drill, mounted on the tool-slide, forms the center required in the head end for the subsequent skirt grinding operation. The outer periphery of the skirt end is chamfered by means of a tungsten carbide-tipped tool also mounted on the cross-slide. The tool for rough-turning the outside diameter part way, mounted on the tool-slide, is advanced 0.0198 inch per revolution.

At the third station, the ring grooves are rough-formed and the remainder of the outside diameter is rough-turned. A set of four tools, preset and locked in their magazine by the cutter grinding department, is mounted on the lower front cross-slide. This set of tools is fed transversely at 0.004 inch per revolution. That portion of the outer periphery of the piston which was not turned at the second station is machined by a tool that is mounted on the slide and advanced 0.0198 inch per revolution. The head end of the piston is supported by a spring-loaded center during this and the two following operations.

The piston is then indexed to Station 4, where

Fig. 5. The Bored Skirt of the Piston is Located on an Arbor Pilot at the First Station of This Six-spindle Automatic Chucking Machine



the ring-groove lands are finish-turned and chamfered, and the head end of the piston is finish-faced. The chamfering tool, mounted on the lower rear cross-slide, is fed transversely at 0.0136 inch per revolution. The tungsten carbide-tipped tool for finish-facing the head is mounted on an auxiliary cross-slide and is fed across the piston at 0.004 inch per revolution. Mounted on the tool-slide at this station is a tool for finish-turning the ring-groove lands. This tool is advanced longitudinally at 0.002 inch per revolution.

At Station 5, shown in Fig. 6, the piston-ring grooves are finish-formed by a set of four tools mounted on the center rear cross-slide. The tools are fed into the grooves at the rate of 0.004 inch per revolution. These four grooving tools are also preset and locked in a magazine by the cutter grinding department, thus avoiding scrap due to incorrect adjustments that might be made at the machine. The width of the grooves is held to a tolerance of 0.001 inch.

The sixth and final station, before unloading the turned piston at Station 1, is used to finish-eccentric-turn the skirt diameter. The tool is advanced at 0.0198 inch per revolution, and is rocked by means of a cam arrangement to generate the con-

Fig. 6. Rear View of the Automatic Machine Shown in Fig. 5. A Set of Four Tools Mounted on the Cross-slide at Station 5 Finish-forms the Piston-ring Grooves

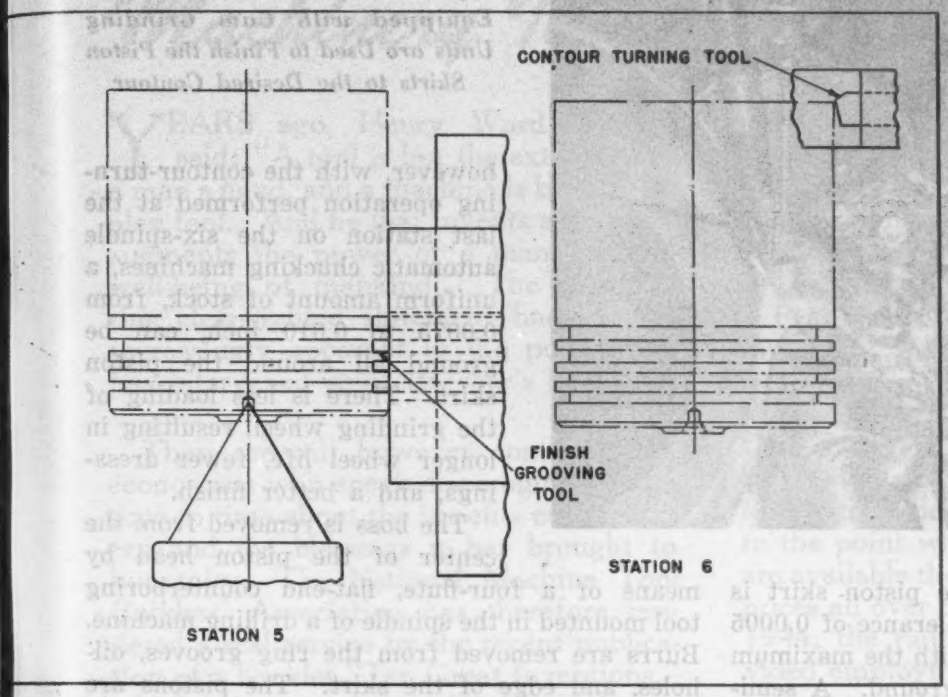


Fig. 7. Tooling Lay-out for Stations 2 to 6, Inclusive, of the Six-spindle Chucking Machines Shown in Figs. 5 and 6. Pistons are Loaded and Unloaded in Station 1

tour desired. The tooling lay-out for Stations 2 to 6, inclusive, of these six-spindle chucking machines is shown in Fig. 7.

The pistons are then transferred to special eight-spindle automatic drilling machines, where oil-holes are drilled through the piston wall in the third ring groove. Eight 1/8-inch diameter high-speed steel twist drills radially located around the periphery of this ring groove are rotated at 600 surface feet per minute and fed at 0.006 inch per revolution.

Three 1/8-inch diameter oil-holes in the bottom ring groove, two 7/32-inch diameter holes in the same groove, and two 7/32-inch diameter holes in the skirt of the piston are then drilled at the same feed and speed in a second operation on similar machines, as shown in Fig. 8. The 7/32-inch diameter holes mark the ends of the expansion slots which are milled in the subsequent operation. These two vertical slots and one radial slot are produced in the skirt by a 3-inch diameter by 1/16-inch thick slitting saw, mounted on the arbor of a hand-operated milling machine. The cutter is revolved at 400 surface feet per minute and is hand-fed through the wall of the piston in less than a second.

Fig. 8. Special Seven-spindle Horizontal Drilling Machine for Drilling Oil-holes and End-holes for Expansion Slots that are Subsequently Milled in the Pistons

Fig. 9. Cylindrical Grinders Equipped with Cam Grinding Units are Used to Finish the Piston Skirts to the Desired Contour

The outside diameter of the piston skirt is then finish-ground to a total tolerance of 0.0005 inch. A taper of 0.001 inch, with the maximum diameter at the open end, is ground. A semi-elliptical cross-section having a major diameter 0.014 inch greater than the minor diameter is also formed in this operation. Cylindrical grinders equipped with 30-inch diameter grinding wheels and cam grinding units, as shown in Fig. 9, are used for this operation.

Formerly, the piston skirt was finish-turned round, which required grinding approximately 0.010 inch per side at high points and an additional 0.0065 inch per side at low points to obtain the desired elliptical type of cross-section. Now, however, with the contour-turning operation performed at the last station on the six-spindle automatic chucking machines, a uniform amount of stock, from 0.0075 to 0.010 inch, can be ground all around the piston skirt. There is less loading of the grinding wheel, resulting in longer wheel life, fewer dressings, and a better finish.

The boss is removed from the center of the piston head by means of a four-flute, flat-end counterboring tool mounted in the spindle of a drilling machine. Burrs are removed from the ring grooves, oil-holes, and edge of the skirt. The pistons are then blown out with air to remove chips, washed with hot water, and dried with an air blast. The land diameter, ring-groove depth, and contour and taper of the skirt are inspected. The pistons are then individually placed on hydraulic weighing and balancing machines, such as the one shown in Fig. 10, where their weight is checked to 454 $\pm$ 2 grams. A 3-inch diameter, inserted-blade milling cutter in the base of these machines is used to remove material from the bosses in the bore of the skirt, when required, for this balancing operation.

After plating, the wrist-pin holes are line reamed and burnished to a total tolerance of 0.0003 inch, square with the outside diameter of the skirt within 0.0015 inch. The line reamers and burnishing tools are mounted on the spindles of geared-head motors. The pistons are again washed, inspected, stamped, and sent to sub-assembly.

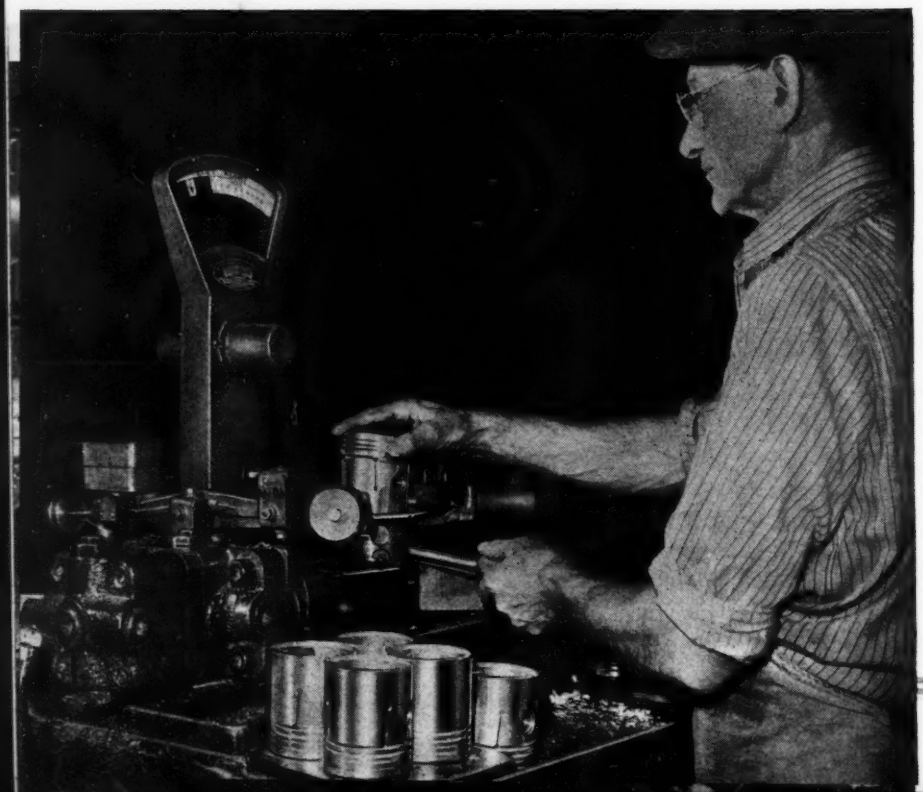


Fig. 10. Pistons are Checked for Weight and Balance on This Hydraulic Machine. A Milling Cutter Removes Metal from Bosses in the Skirt Bore when Required

Facts Prove that Labor-Saving Machinery Increases Employment

YEARS ago, Henry Ward Beecher said: "A tool is but the extension of a man's hand, and a machine is but a complex tool. And he that invents a machine augments the power of a man and the well-being of mankind." The truth of this clear-sighted statement has become increasingly apparent in the period that has intervened since Beecher's day.

There are still, however, some pseudo-economists who speak disparagingly from time to time about the benefits of machinery and the blessings it has brought to humanity. The National Machine Tool Builders' Association has therefore rendered a real service by the recent publication of a booklet "Ten Great Inventions," which traces conditions in various industries before and after certain inventions that have profoundly affected human progress. Indisputable facts prove that greater employment follows the development of high-production machinery as surely as night follows day.

Back at the close of the Eighteenth Century when the weaving loom was first developed, a mob in England surrounded a factory that had been equipped with five hundred looms, fought for two days, killing two men and wounding a considerable number. Finally, the mob smashed the looms and burned the factory to the ground. These violent deeds were perpetrated in the fear that automatic machinery would throw them out of work. And yet, between the years 1830 and 1914, the number of workers in the English textile industry increased three and one-half times, while the population only doubled during that period.

In the United States, one out of every 152 persons was employed in the textile industry in 1870, whereas at the time of the last census in 1940, one out of every 60 persons was employed in that industry. High-production textile machinery had increased employment 250 per cent!

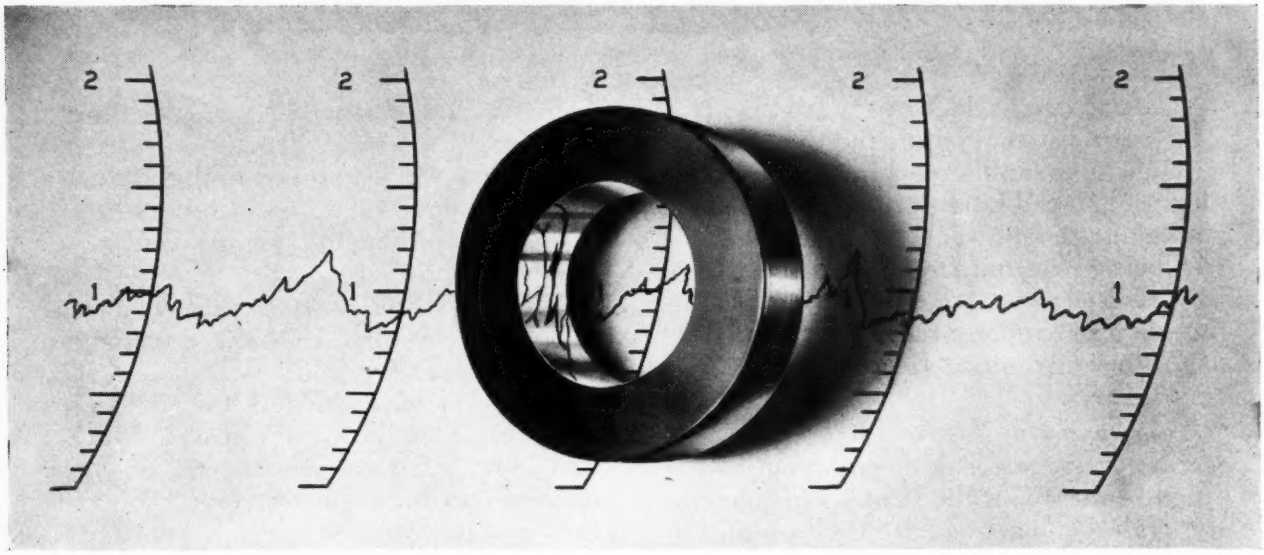
Prior to 1869, it took mule-team caravans six months to haul merchandise from Kansas City, Mo., to Santa Fe, New Mexico. A load worth $3000 in Kansas City cost $15,000 by the time it reached Santa Fe. Steam, electric, and Diesel locomotives have cut transportation costs to the point where even perishable foods are available the year around at reasonable prices all over the United States. And, in 1944, the railroads in this country provided employment for one million and a half persons!

Before the invention of the typewriter, only four out of every thousand persons did office work. Today, even with the addition of other types of business machines, there are fifty persons out of every thousand doing office work—an increase of 1250 per cent!

Such examples of greatly increased employment as a result of technological advances can be multiplied many times. They prove convincingly that machines shorten hours, raise wages, and make it possible to manufacture the things we need in order to maintain our standard of living, at prices that people can afford to pay. Machines make living easier for everyone. The trouble is that not all people are able to see how much labor-saving inventions have benefited them. As a matter of fact, the inventions of future years will probably bring opportunities for still better jobs and an even higher standard of living.

Charles O. Herb

Accurate Holes with 0.6 Micro-Inch



PRECISION finishing of holes in hardened steel parts generally requires the use of both a rough- and finish-grinding machine, and a honing, lapping, or superfinishing machine. However, holes can be ground to size within 10-millionths inch on the diameter, within 5-millionths inch for roundness and straightness, and to finishes of less than 1 micro-inch r.m.s. by means of a single set-up on an internal grinding machine by following the practice to be here described. It employs techniques and equipment developed by the Bryant Chucking Grinder Co., Springfield, Vt., for grinding such precise holes.

During World War II, the bores of fuel injector plungers for Diesel engines were held to within 20-millionths inch on the diameter, within 5-millionths inch for roundness and straightness, and to finishes of from 3 to 4 micro-inches r.m.s. on Bryant internal grinding machines. Now, with improved machine design and closer control of such variables as temperature, vibration, and alignment, dimensional accuracy and surface finishes have been improved still further.

The geometry of a hole—dimensional accuracy, roundness, and straightness—together with the proper surface finish, can contribute substantially to the wearing quality of a hole. Grinding with a rigid, correctly aligned machine will finish a hole to shape more accurately than any other process, and at the same time produce a clean-cut surface that is free from cold-worked or so-called amorphous metal. Herein lies the advantage of grinding as a final process for hole finishing. In one case carbide-faced, tool-steel dies, ground to a finish equal to that of lapped dies (1 micro-inch r.m.s.), gave two to six times the wear of lapped dies, due to the more accurate control of shape.

Another advantage of repetitive dimensional accuracy is that it permits interchangeability of mating parts, thus eliminating selective assembly. Ball and socket joints of Pyrex glass for laboratory use are now being precision-ground with diamond wheels dressed for this purpose.

Sample ground ring gages, such as the one shown in the heading illustration superimposed on a profilometer chart, have been checked by both the National Bureau of Standards and the Frankford Arsenal Gage Laboratory. One gage that was measured by the Bureau of Standards in three planes, 60 degrees apart, and at various distances from one end of the gage, showed the following variations from the required diameter:

Distance from End of Gage, Inch	Variations from Required Diameter, Millionths of an Inch		
	Position 1	Position 2	Position 3
0.12	—2	—1	—1
0.22	+5	+3	+5
0.27	+5	+3	+5
0.32	+3	—1	+4
0.42	—1	—3	+1
0.52	—5	—5	0

A second set of ratings, made on the contact type internal measuring machine by the Bureau of Standards, showed an average difference from the original values of 0.000002 inch. All measurements were made at a temperature of 68 degrees F. The elastic deformations of the ring

Finish Ground in One Set-Up

Methods Employed and Equipment Required in Grinding Holes to within Ten-Millionths Inch in Diameter, within Five-Millionths Inch for Both Roundness and Straightness, and to Finishes of Less than 1 Micro-Inch R.M.S.—a Revolutionary Development in Internal Grinding

By CHARLES H. WICK

gage and the gage-block combination used as a standard were computed and found to differ by less than 0.000001 inch at the point where the jaws and diamond contacts meet, when subjected to the test load of 4 3/4 ounces. Measurements were also made with an air gage. As an air gage measures average diameter over an area of surface equal to the size of the air jets, the readings obtained with it varied less than with the contact measuring device. The average deviation from the mean surface of this particular gage, determined with a Brush surface analyzer, was found to be 1 micro-inch r.m.s.

To obtain this type of dimensional accuracy and surface finish, the grinding machine used must be rigid, so as to prevent vibrations or deflections of the grinding wheel or work; the axis of the grinding-wheel head must be parallel to the axis of the work-head in all planes; and a fine feed and proper wheel speeds must be available. An important design feature of the internal grinding machine employed for this work is the use of pre-loaded ball bearings on the hardened and ground cylindrical slides, which permits sensitivity without the loss of rigidity. This eliminated the objectionable feature on previous models of internal grinders in which the oil film on the slides caused slight floating, resulting in misalignment of the heads with relation to each other.

To maintain the optimum surface speed of 5500 feet per minute, even with small diameter grinding wheels, Bryant has designed a high-frequency motor, Fig. 1, that directly drives the wheel-spindle at speeds up to 100,000 R.P.M. Belt-driven spindles are considered satisfactory up to about 40,000 R.P.M., but at speeds above this, vibration and actual bending of the spindle have been encountered, due to centrifugal force of the belt.

A standard alternating-current motor is used to drive a converter or alternator, which supplies high-cycle current to the wheel-spindle motor. A speed of 100,000 R.P.M. requires approximately 1650 cycles. The mechanical problems involved in building such a compact, high-speed motor were many. Norgren lubricators, which inject about 10 drops per minute of S A E 10 spindle oil into a stream of compressed air maintained at from 12 to 15 pounds per square inch, create a fog that lubricates and cools the spindle and bearings. The temperature of the spindle

Fig. 1. Assembly and Component Parts of a Compact, High-frequency Motor that is Employed to Turn the Wheel-head of Internal Grinding Machines at Speeds up to 100,000 R.P.M.

during operation is maintained at between 90 and 110 degrees F. One such wheel-spindle has been in continuous operation sixteen hours a day for more than six months without repairs.

One single-row, angular-contact, precision ball bearing is placed at each end of the spindle. Grooves ground in one operation on the spindle itself form the inner races of the bearings. This eliminates problems of parallelism and other possible errors when using separate inner races. Also, the elimination of inner races permitted increasing the diameter of the shaft in relation to the size of the bearing, thus making the shaft more rigid and increasing its strength by 25 per cent.

The outer races of the bearings are carefully fitted into their housing so that expansion due to operating temperatures will not interfere with their proper operation. This motor requires about 2 H.P. to start, and consumes about 3/4 H.P. while running idle, with a slip of only 2 per cent. The shaft is made of S A E 52100 steel, tempered to a hardness of from 38 to 42 Rockwell C and then hardened by induction heat in the area of the ball grooves to from 65 to 68 Rockwell C.

Before the bearings are installed, the spindle is placed on V-blocks, mounted on a special Gisholt Dynetric balancing machine, where it is rotated and counterbalanced to the limit of the machine. After assembling the bearings, the spindle is placed in a water-jacketed, machine-steel housing and is ready for installation on the grinding machine. Grinding wheels, bonded onto threaded shanks, are screwed into the bore of the spindle ends.

The machines employed for this special grinding operation are installed in a separate room, the temperature of which is maintained at 68 degrees F. to prevent heating and expansion of the work, gages, and machine parts.

The machines are placed on separate concrete blocks which rest on cork bricks, as shown in Fig. 2. This special base efficiently eliminates vibration from other parts of the shop or from outside the building. The separate concrete block on which the machine sets is poured in place directly on the cork bricks at the bottom of the pit. Wooden blocks are placed in the air spaces indicated at the sides of the drawing before the casting operation and are removed after the concrete has set. The cork bricks at the base of this special foundation are made 3, 4, or 5 inches high, depending upon the weight of the machine to be installed.

Such a method of vibration elimination is essential in obtaining good surface finishes. For example, it has been found that a correctly aligned machine in good condition, operating on an ordinary foundation in the shop, will have difficulty producing surface finishes less than 4 micro-inches r.m.s. The same machine placed on a special vibration-eliminating foundation, but still exposed to ordinary shop temperatures, will produce surface finishes of from 1 to 2 micro-inches r.m.s. When air conditioning and machine temperature control are added, the finish obtained is 1 micro-inch r.m.s. or less.

It has been found that even though a cold machine may be in perfect alignment, the accumulation of heat in the hydraulic system, wheel-head, and coolant system after a period of operation will disturb the alignment enough to spoil the required fin-

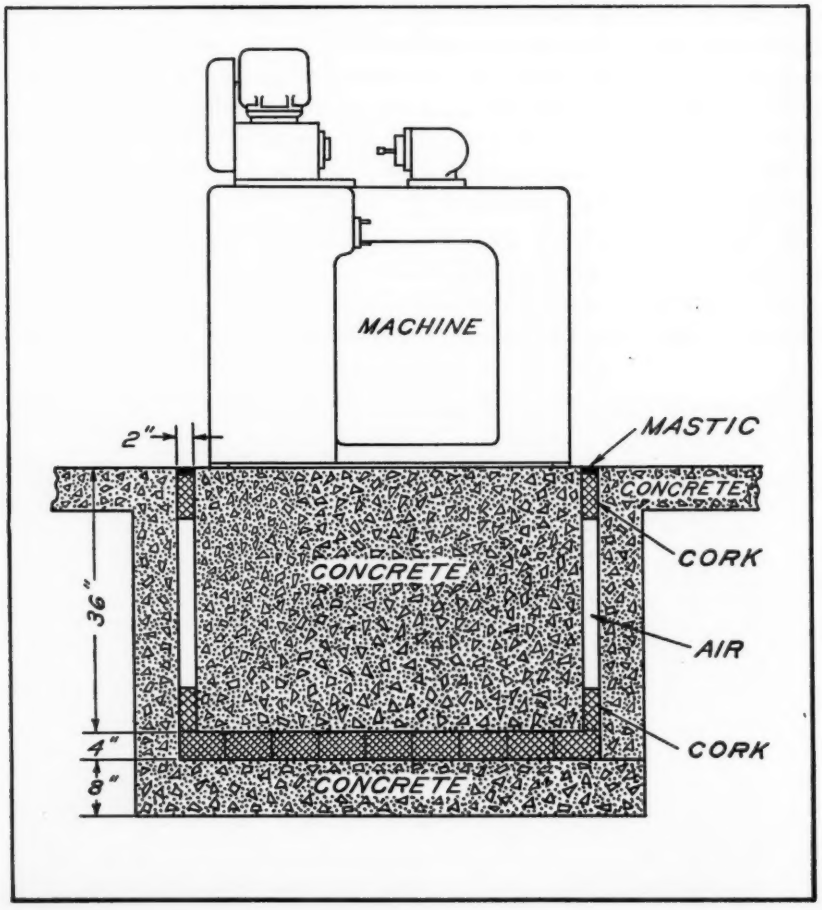


Fig. 2. Special Foundation Developed for Internal Grinding Machines, which Minimizes the Transmission of External Vibrations and Permits the Grinding of Micro-inch Finishes

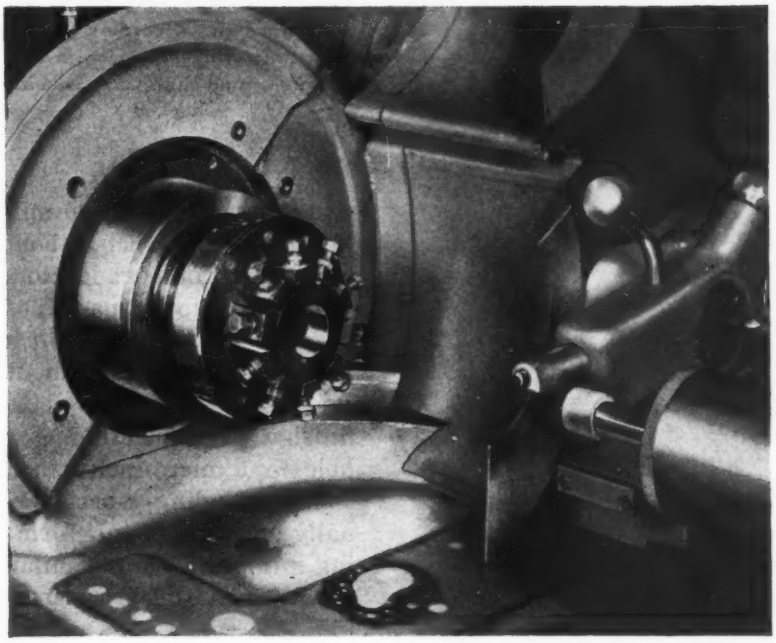


Fig. 3. A Ring Gage which has been Ground to a 0.6 Micro-inch r.m.s. Finish is Shown Mounted in the Diaphragm Chuck of an Internal Grinder. The Grinding Wheel has Not Become Loaded or Glazed

ish. For this reason the room is temperature controlled, the coolant is passed through one refrigerating unit, and the hydraulic oil is cooled by another unit. The wheel-head temperature is maintained by a constant flow of coolant through a water jacket. Both Cimcool and Kleen-Kut coolants have been used with good results. The prime function of temperature control, however, is not to get a fine finish. Without it, size control, to within millionths of an inch, would be impossible.

Sample ring gages, the measurement of which has been previously described, are being made from S A E 4150 steel, hardened to from 45 to 50 Rockwell C. The ring shown mounted in a diaphragm chuck of the internal grinder in Fig. 3 was turned at 1800 R.P.M., and a 1 1/4-inch diameter grinding wheel, slightly narrower than the work being ground, was revolved by a high-frequency wheel-head at a surface speed of 5500 feet per minute, to produce a 0.6 micro-inch r.m.s. finish. A copy of the profilometer reading obtained for this gage is shown in Fig. 4. The instrument was set on the 3 scale, and a variation between 0.55 and 0.65 micro-inch r.m.s. was recorded.

A straight grinding wheel, with abrasive and bond arranged in an open structure, is used to produce these fine finishes on this type of steel. Unfused aluminum-oxide wheels, 60 grain size and with a vitrified bond arranged in a No. 8 structure, are employed. The use of a less dense, relatively wide-grain spacing in the wheel requires less pressure for grinding, which is very desirable, since less mass and strength are required in the machine to offset deflections resulting from this pressure. The diameter of this type of wheel is reduced approximately 0.001 inch in grinding 0.010 inch from the bore of the work.

About 0.010 inch of stock is removed from the diameter of the hole in a rough-grinding operation requiring about 1 1/2 minutes. After diamond dressing the wheel, approximately 0.001 inch is removed from the diameter in a finishing

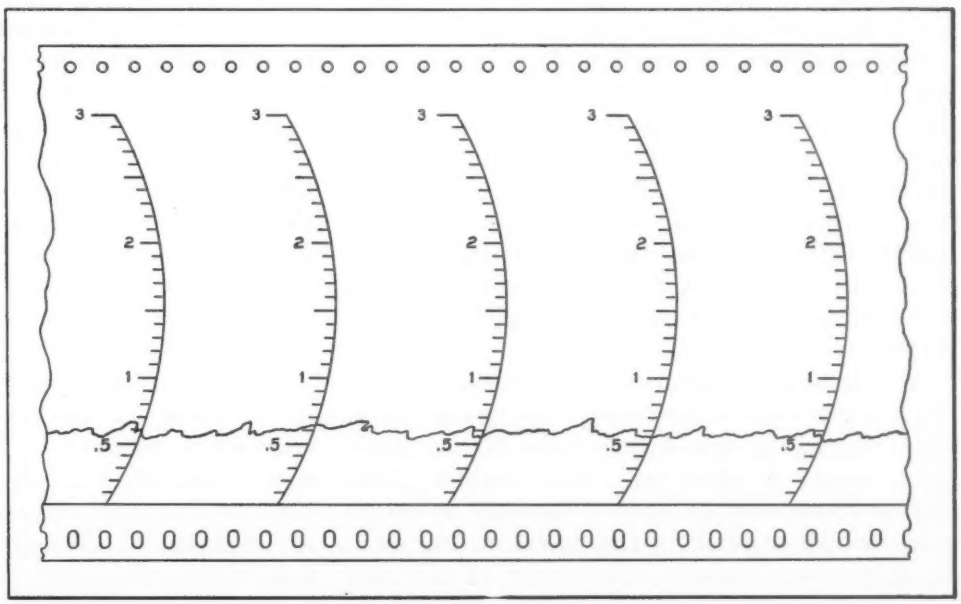


Fig. 4. Profilometer Reading Chart for Ring Gage Shown in Fig. 3. The Instrument was Set to Record on the 3 Scale and a Reading of between 0.55 and 0.65 Micro-inch r.m.s. was Obtained

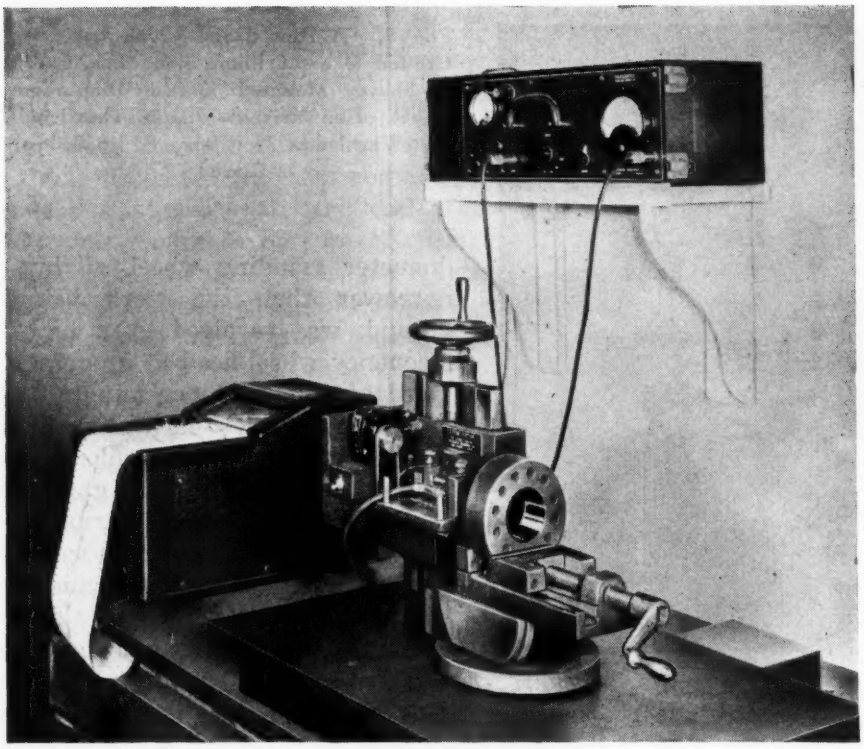


Fig. 5. Profilometer Set-up for Indicating or Recording Micro-inch r.m.s. Finishes. Here a Precision Ground Ring Gage is being Checked

operation. A hand feed is employed for this finishing operation, advancing the wheel into the work in increments of about 0.000005 inch. This is accomplished by turning the feed-screw hand-wheel, graduated in 20 millionths of an inch, about one-quarter of a graduation. From eight to ten passes of the wheel through the work are made per feeding. About ten minutes is required to finish a 1 1/4-inch diameter hole to 1 micro-inch r.m.s.

The grinding wheel actually cuts the metal, forming miniature chips similar to those resulting from turning. The wheel does not become loaded or glazed during finish-grinding, and will spark if used to rough-grind a new piece without first dressing the wheel. Air gages are used to check the size of the holes, and a profilometer set-up, shown in Fig. 5, is employed to measure the micro-inch r.m.s. surface finish.

Salvaging Over-Sized Parts by an Acid Etch

By DONALD A. BAKER

Some time ago our shop found itself with three very expensive crankshafts that were 0.001 inch over size on the splined end as the result of a nitriding operation. To stone off this amount would have been both difficult and expensive.

The suggestion was made that the excess stock might be removed by an acid etch. In order to try out the idea, a discarded plug gage was measured and placed in a pickling tank in the plating department. After about fifteen minutes, it was removed, washed, and measured again. Still being somewhat over size, it was put back in the tank for thirty minutes more and was then washed and cleaned with a scratch brush.

At this stage, it was found to contain many small pit marks—a condition that would necessitate scrapping the crankshafts if the same thing occurred when they were etched. This pitting was caused by uneven building up of the oxide, which resulted in tiny spots on the shaft being exposed longer to the action of the acid than the main body of the shaft; the acid ate into the metal and seemed to spread out under the surface, causing even larger pit marks to be formed, which were hidden from view.

As a corrective measure, it was decided to dip the piece for only short periods of time and clean it between dips with a scratch brush, so that the entire surface was exposed to the acid all the time. This was tried on a piece of steel from which the shafts were made and worked satisfactorily. The shafts were then exposed in the same manner, and all of them were saved.

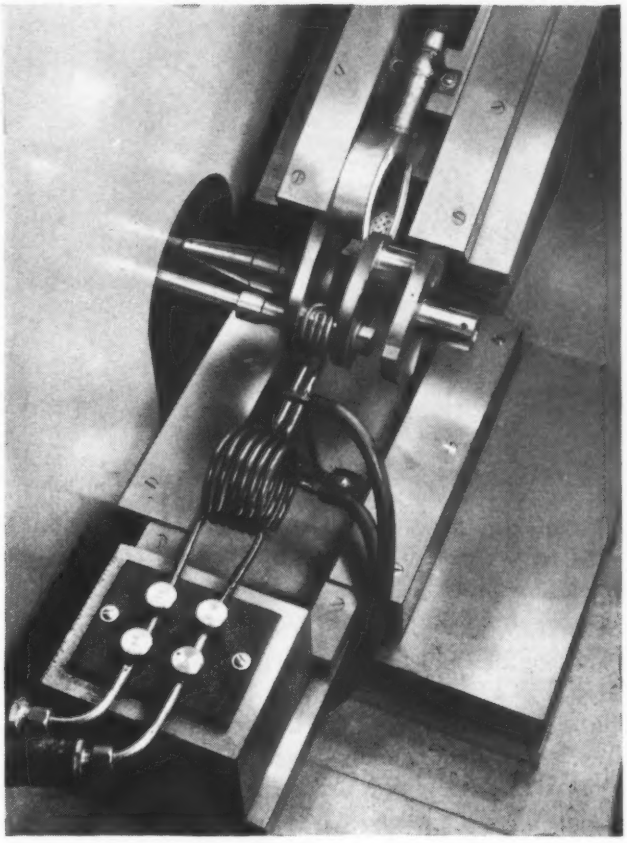
* * *

Westinghouse reports that an entirely new construction for the cases of marine gears has reduced the weight of the units about 10 per cent. Instead of a heavy welded or fabricated housing, the gear-case now consists of a skeleton of steel beams encased in a light-gauge aluminum-alloy housing.

Tooling Requirements for Induction Heating

The Success of Induction Heating can be Attributed, in Part, to the Fixtures and Work-Handling Equipment Used to Position and Remove the Work from the Heating Coil. Some Installations Engineered by Lepel High Frequency Laboratories are Described in This Article

By OTTO WEITMANN, Vice-President
Lepel High Frequency Laboratories, Inc.
New York City



SINCE the principal advantage of induction heating lies in its almost instantaneous effect on the work, the handling time, and not the heating time, becomes the factor that in many cases determines the production rate. An installation can be designed so that its operation is either entirely automatic, semi-automatic, or manual. It is obvious that automatic handling of the work can be justified only if job lots are large, if a mechanized set-up can be adapted to smaller production quantities when necessary, if the parts are of such a size and shape that separate handling would result in loss of production, or if mechanization is necessary to insure uniform heating of the part.

Of course, a certain amount of tooling always is required, so that the work will be exposed to the field of the load coil. The extent of such devices as holding and aligning fixtures and clamps depends largely on the size and shape of the work; in casehardening applications, they are generally needed for the positioning of the work concentrically to insure a uniform heat pattern. In addition, variable-speed feeding mechanisms and rotating devices may be required. The equipment shown in the heading illustration for hardening the bearing surfaces of small crankshafts is typical. In it are incorporated a center that positions the bearing surface in a tunnel-shaped coil; a motor drive that rotates the shaft at 30 R.P.M.; a spray ring to quench the heated area; and an air piston that moves the quench ring so that it encircles the part at the proper time in the cycle. Using this mechanism and a 30-K.W. converter, bearing surfaces 3/4 by 1 inch in size are heated and quenched at twenty-second intervals.

A multitude of other arrangements can be designed to accommodate various types of work for selective hardening, brazing, and annealing. One of the most common methods of handling is simply to place the work in a coil, one piece at a time, and position it with transite blocks or a similar insulator. After the heating cycle is completed, the piece is removed and quenched, if necessary. Heating time is automatically controlled, so that unskilled personnel, often women operators, can perform the work. Such an arrangement is best suited for job-shop operations, where production runs are limited to a few hundred units and where versatility in changing from one job to another is of prime importance. Several types and sizes of coils are usually kept on hand to handle different kinds and sizes of work.

Sometimes more than one piece can be heated in the same coil. Such an arrangement is illustrated in Fig. 1, which shows the coil and handling fixture used in brazing formed brass sections into vanity mirror handles. The handles are

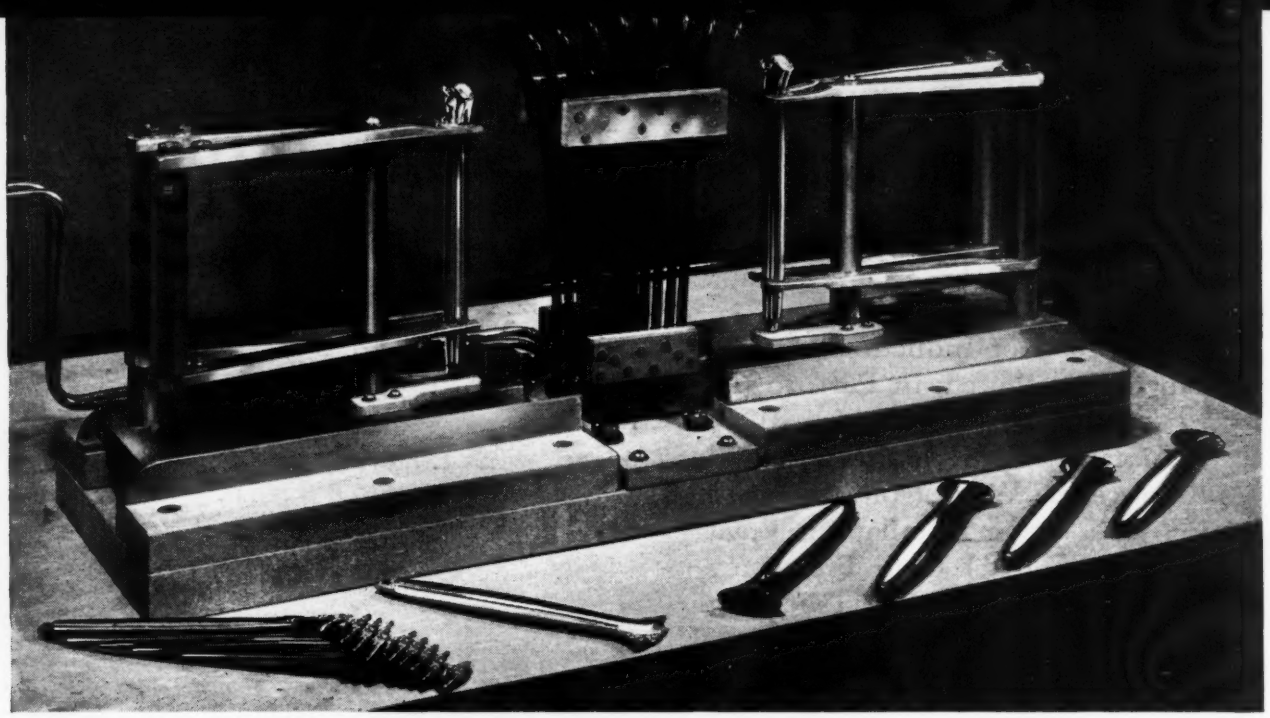


Fig. 1. Formed Strips of Brass, Mounted in a Fixture that Slides in a Groove, are Brazed Two at a Time in a Special Contour-following Coil

brazed two at a time in a coil that is shaped to produce an even heat pattern. Both sections are held by a spring-actuated hand clamp; these clamps are mounted on a baseplate that slides in a machined groove.

The operator simply clamps the sections in place, hangs a piece of solder that is bent into the form of a fishhook over the edge of the work, slides the parts into the coil, and presses the control button. When voltage is induced in the parts by a 30-K.W. spark gap converter, it heats the parts, thus causing the solder to melt and flow down the joint. Using an acetylene torch, an operator can braze only 250 handles per day. With this simple fixture, production can be increased to 2800 per day.

Another variation of single-coil loading is shown in Fig. 2. This coil is large enough to accommodate several assemblies, and can be used for a variety of work. The job illustrated is a soft-soldering application on small brass cylinders approximately 2 inches long by 1 inch in diameter. A total of sixteen brass tubes—two per cylinder—are soldered simultaneously when the assemblies are placed in the field of the coil.

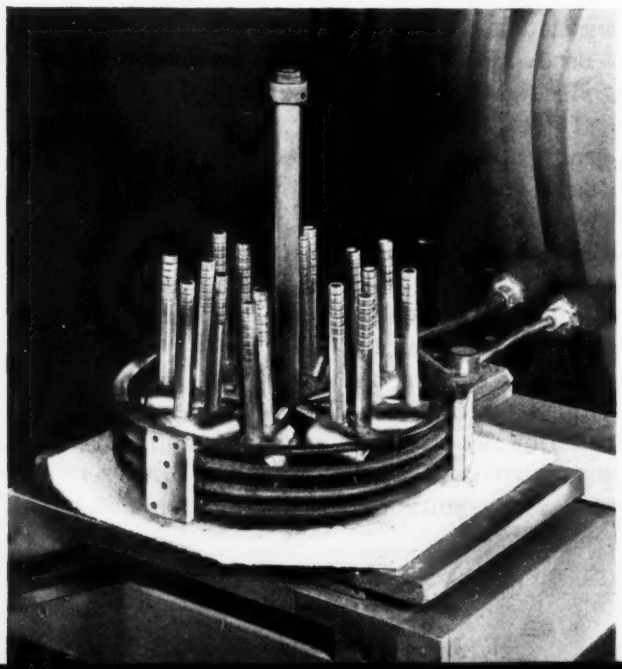


Fig. 2. Several Parts can be Heated Simultaneously in the Multi-turn Coil Shown Here. It is Designed for Batch Soldering of Small, Job-lot Pieces in Cases where Accurate Control of the Heat Pattern is Not Necessary

While neither of the coils illustrated in Fig. 1 or Fig. 2 makes efficient use of the available power, because of loose coupling between the coil and the work, such considerations are secondary to the simplicity of the coil and of the joining procedure. They cannot be used in cases where an accurate heat pattern is required, but are effective for soldering or brazing operations where the conduction of heat through the part results in a satisfactory joint, and where localized "hot spots" are not severe enough to affect the strength of the assembly.

However, for certain classes of work, single-coil fixtures can be designed to follow the pattern of the work closely, like the coil shown in Fig. 3, which is employed for surface-hardening gear teeth. Not only must the heat pattern be uniform, but the heating and annealing cycle must be closely timed to give the depth and hardness of case specified. The set-up consists of a lever-operated locating fixture, which can be

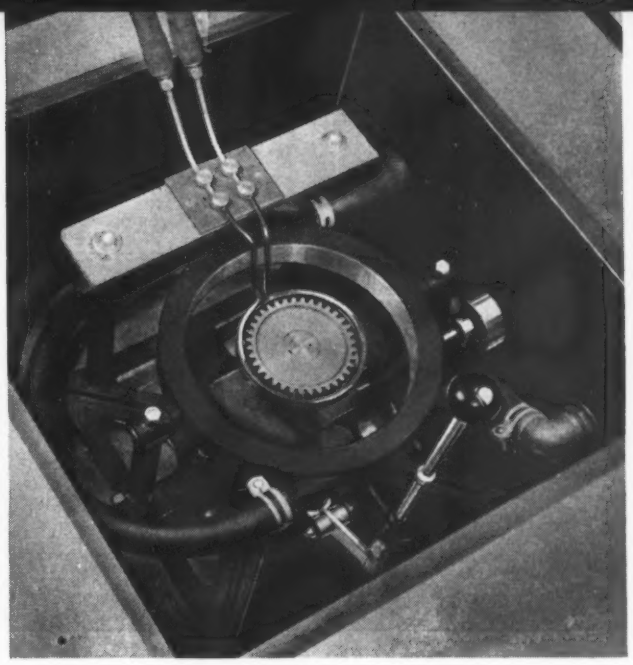


Fig. 3. Casehardening of Gear Teeth Usually is Done in a Manually Loaded Coil in Order to Insure Uniformity of the Heat Pattern. The Heating and Quenching Cycle can be Timed so as to Give Constant Quality of Product

raised to facilitate loading and unloading of the gear and lowered for heat-treating.

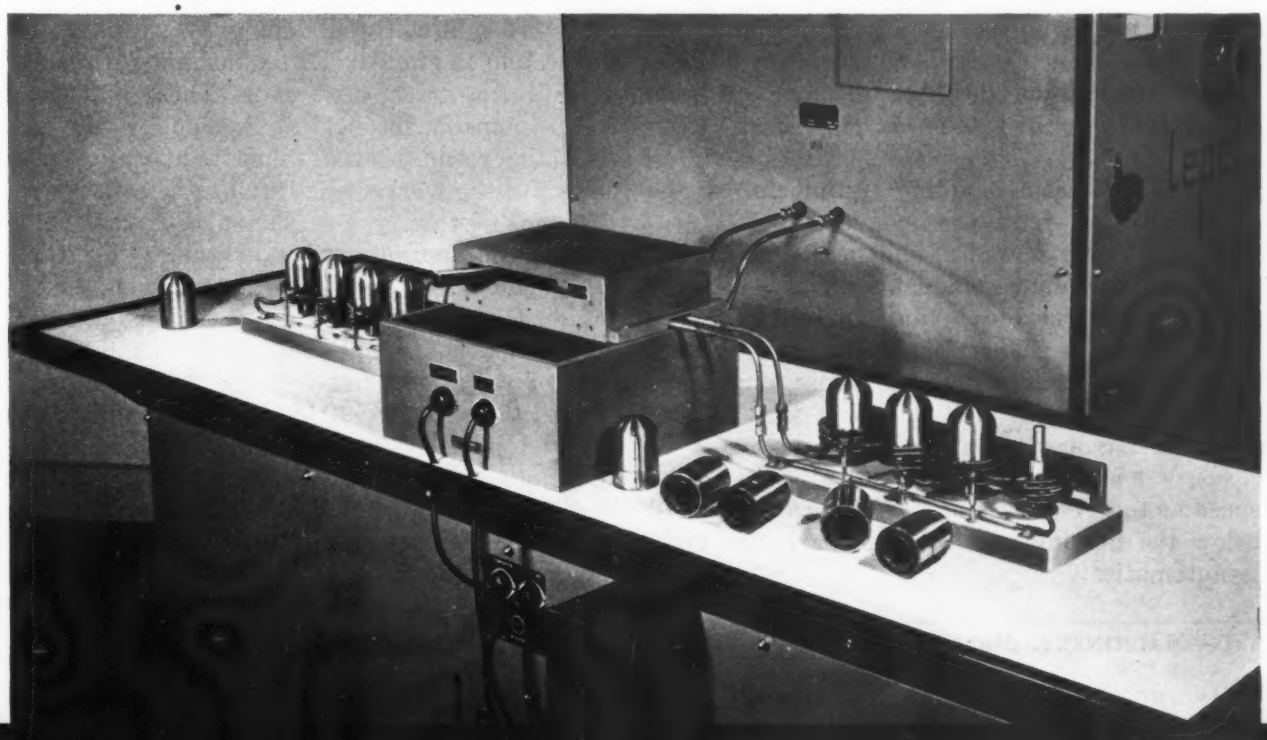
If production requirements are high, single coils can be wound in series to form the so-called "gang" coil; with this, several parts or assemblies can be heated simultaneously. Fig. 4 illustrates such an arrangement. It accommodates four small steel domes and steel adapter rings which are brazed at one time. Since specifications for this part required that the joint be able to withstand a pressure of 1500 pounds per square inch, the heat pattern had to be uniform around the shell.

The installation was further refined and production increased by using switching equipment in conjunction with the gang coils in order to transfer the output of the induction generator from one coil to the other. With this arrangement, the operator could load four assemblies in one coil while the other was heating, then switch coils, remove the brazed parts, and load the other assemblies. One set of four assemblies is heated to 1200 degrees F. every thirty-five seconds (an output of about 400 parts per hour) with this fixture and a 30-K.W. high-frequency converter.

Surprisingly, while such an installation is manually operated to the extent that the operator must load and unload the parts, it equals or excels many automatic set-ups in production rate, and at the same time gives a uniform heat pattern. This is due to the fact that the load coils used with mechanized equipment cannot always be designed for the best efficiency, which may result in a slightly longer heating cycle or in a somewhat less desirable heat pattern, or both.

Moreover, mechanization introduces an additional maintenance problem. Since the handling equipment may perform functions such as applying pressure on the part, feeding the part (either continuously or step by step), cooling or quenching of the work after heating, ejecting

Fig. 4. The Two Multiple Coils Shown are Connected to a Spark Gap Converter through a Manual Switching Arrangement that Permits One Coil to be Loaded while the Other is Heating the Work. This is a Brazing Operation on Small Steel Dome Assemblies, which are Joined at the Rate of About Four Hundred an Hour



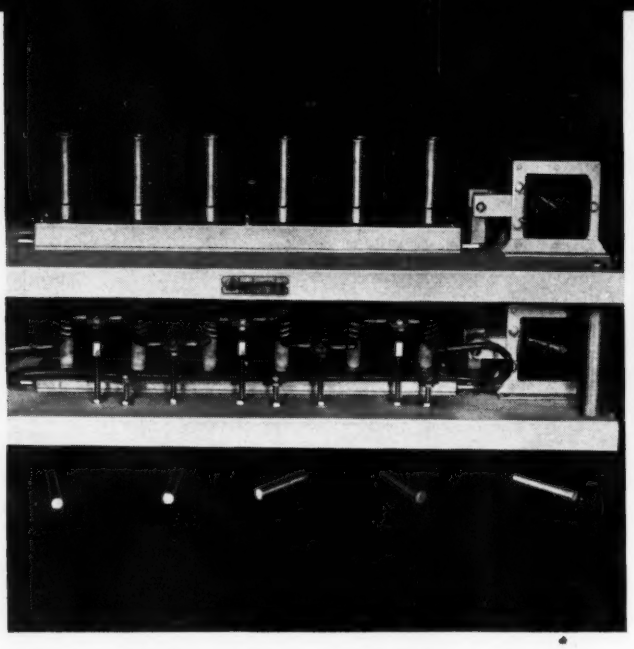


Fig. 5. Multiple-coil Heating can be Further Mechanized by Handling Equipment Similar to the Solenoid-controlled Fixture Shown. Parts are Fed into Tubes at Top of Fixture and are Automatically Dropped into a Quenching Medium when Heating Cycle is Completed

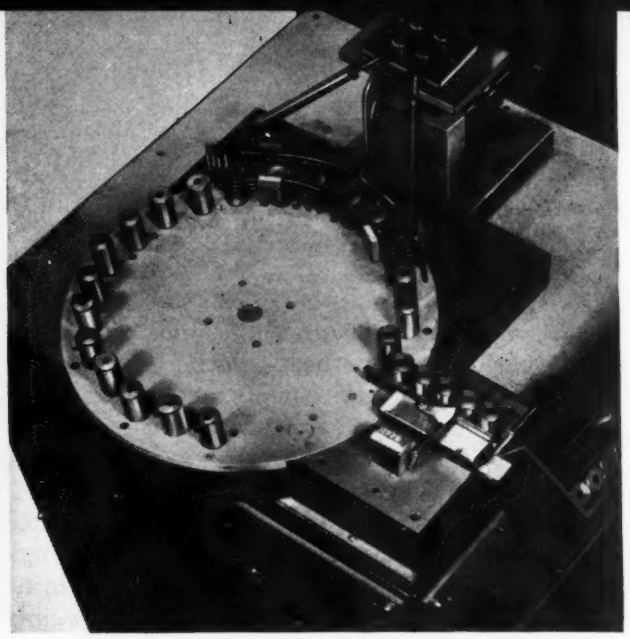


Fig. 6. Used with a High-frequency Converter, a Turntable is Essentially a High-production Device. The Unit Shown Handles Six Hundred Steel Bushing Assemblies per Hour, and Automatically Ejects and Counts the Units after They have been Soldered

the work after completion of the heating cycle, rotating the work, and switching the power on and off, it usually contains a number of moving parts. Even with preventive maintenance, the "down time" of the equipment is more than with the less complicated manual arrangement.

These disadvantages may not, however, offset too greatly the advantage that a continuous-feed process offers in certain applications. For example, multi-turn coils can be used in some instances with mechanical devices that speed production through simplified handling. Fig. 5 shows a solenoid-controlled six-position gang coil for hardening the tips of 5/16-inch diameter steel pins. The tubes at the top of the fixture act as hoppers for the parts, which are dropped into them prior to the start of the cycle. After the cycle is completed, a solenoid retracts the stop in the tubes, thus permitting the parts to drop into the quenching medium. Production with this device is at the rate of six pins every fifteen seconds.

Other automatic handling equipment can be classified into three types—conveyor belts, turntables or indexing tables, and progressive heating and quenching mechanisms. The latter type of mechanism provides a constant feed and rotational speed for the surface-hardening of round stock, which cannot be accurately duplicated with manually operated equipment. The feeding and rotating mechanism is, in the majority of cases, a long lead-screw driven by a variable-speed motor. A quench ring or bath can be placed below the heating coil, so that the entire cycle is automatic.

Perhaps the most widely used, although not necessarily the most efficient, handling devices are turntables and conveyor belts. They have been applied to a variety of heating jobs on which a continuous flow of parts decreases the amount of handling that would otherwise be necessary.

The load coils used in conjunction with conveyor belts and turntable arrangements are of necessity the open-end type, so that the work can flow under or between them. The "pancake" or flat multi-turn coil is commonly used, as is the tunnel-shaped coil. The latter type can be designed in a variety of shapes to suit individual conditions; its advantage lies in the simplicity with which it can be built and in the ease of application of the quenching medium. Still other types are split coils and double-layer coils, which are wound in standard helix fashion with a few extra turns at the exit end. These additional turns intensify the field at that end of the coil, with the result that a sharp temperature rise occurs in the work while leaving the coil.

A coil of this type is shown in Fig. 6 being used in conjunction with a turntable. The turntable, commonly applied for continuous soldering, brazing, and annealing of ferrous and nonferrous parts, is equipped with variable-speed control and a mechanism that ejects the finished work. In this case, a 1-inch diameter steel bushing and steel washer are being soft-soldered at the rate of 600 per hour. The final temperature is 450 degrees F. To assure uniform heat distribution, the parts are rotated during the heating cycle by the same drive that rotates the table.

Precision Boring of Cylinder Blocks on an Automatic Transfer Machine

IN order to meet production requirements of seventy-five eight-cylinder automotive cylinder blocks per hour, duplicate operations are performed simultaneously on two blocks in an automatic, transfer type processing machine containing fourteen stations. This is one of the latest machines especially designed and built by Greenlee Bros. & Co., Rockford, Ill., to increase productivity and reduce post-war mass production costs. The automatic transfer method permits a substantial reduction in work-handling and consequently in operator fatigue. While the machine is designed for high production, close tolerances can be maintained.

This machine semi-finishes and finish-bores the camshaft and crankshaft bearing diameters, finish-straddle-mills the center main bearing, and finishes the V-shaped oil and cork grooves. The cycle is entirely automatic. After sliding two engine blocks into the loading station, shown in the foreground of Fig. 1, the operator simply presses the starter button. The machine automatically transfers the blocks from the loading station to the first working station, between a left- and a right-hand head. Here, the blocks are raised into the operating position, clamped on their pan rails as illustrated in Fig. 2, and machined.

Main bearing caps are assembled to the blocks with cap-screws before the blocks come to this machine. Because of the design of the engine blocks, the crankshaft bearing diameters of two blocks are simultaneously semi-finish-bored from the back ends of the blocks by the two boring-bars on the left-hand head at this station. At the same time, the camshaft bearing diameters are semi-finish-bored from the front end of the block by the boring-bars on the head at the right.

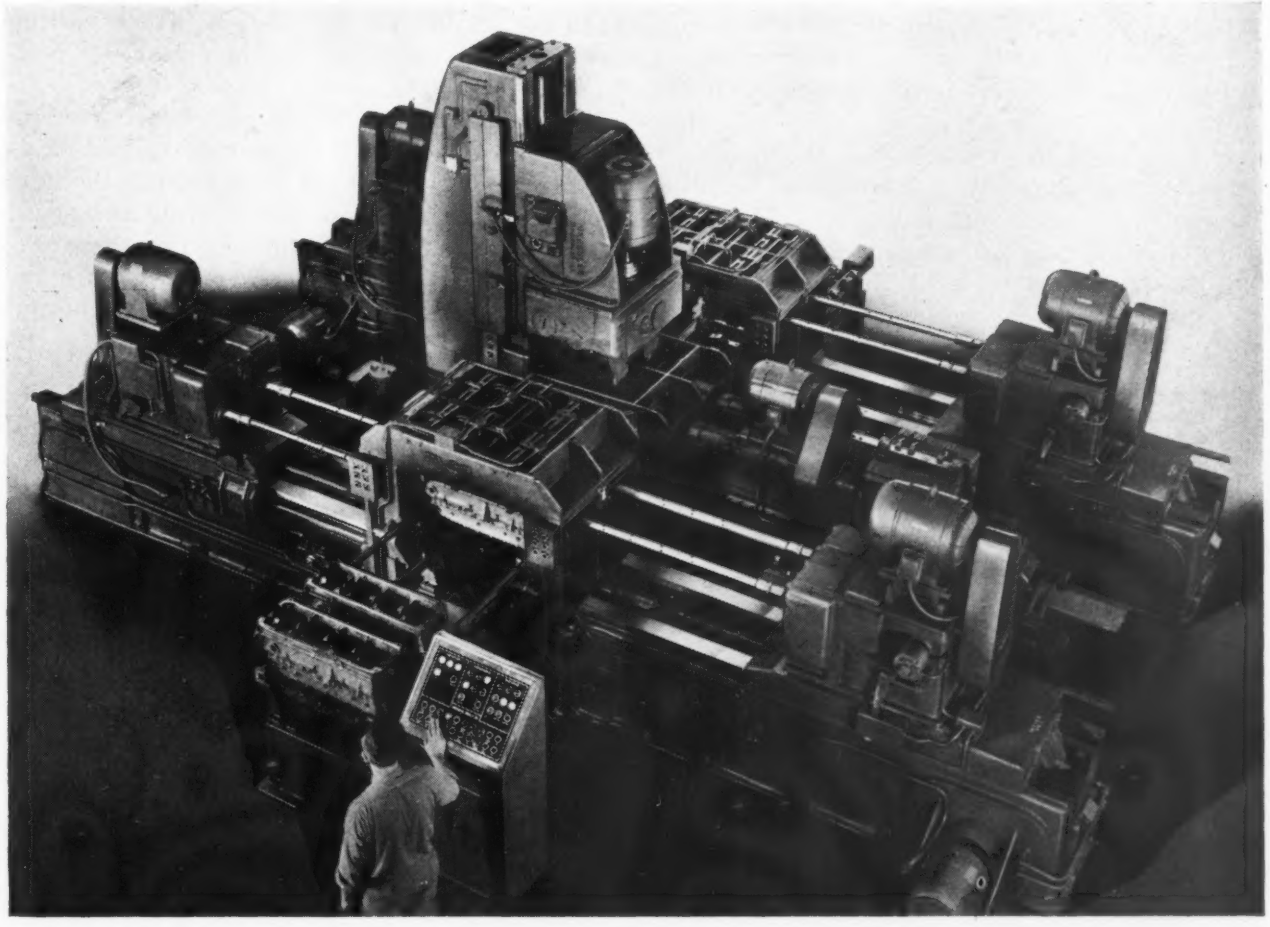


Fig. 1. Front View of Greenlee Automatic Transfer Processing Machine, Showing Two Automotive Engine Blocks at the Loading Station in the Left Foreground

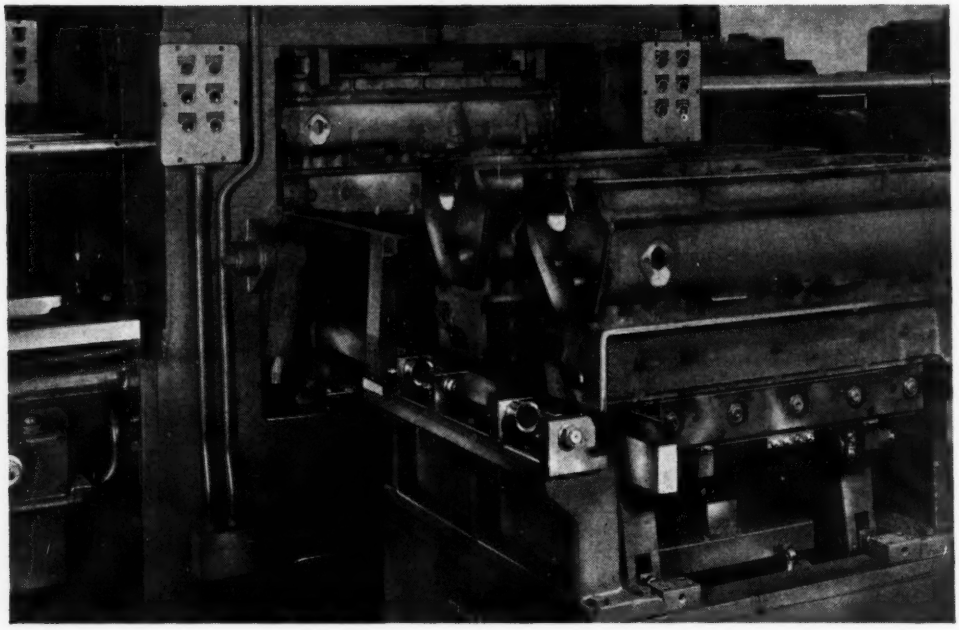


Fig. 2. Close-up View of the Loading Station on Machine Shown in Fig. 1. The Two Engine Blocks are Raised into the Operating Position and Clamped on Their Pan Rails at the First Machining Station, Shown in Back of the Loading Station

The boring-bars are rotated at the rate of 315 surface feet per minute in stationary aluminum bronze bushings, seen at the top center in Fig. 3. Each bushing has a keyway through which the tungsten-carbide tipped tools pass during the rapid approach and return strokes of the boring-bars. At the end of the cutting cycle, the boring-bars automatically stop with the tool bits in proper radial alignment with the keyways in the bushings.

After passing to an idle station, the blocks are automatically transferred to the next working stations in the center of the machine. Here, two pairs of carbide-tipped, straddle milling cutters, mounted in a vertical head, finish the sides of the center main bearings of each engine block. The cutters rotate at a speed of 370 surface feet per minute. Simultaneously, at the same station, single-point carbide tools, rotating at 390 surface feet per minute, mounted in a horizontal head, are rapidly advanced and fed hydraulically to generate the V-shaped oil and cork grooves in each block. At the completion of the cutting cycle, the heads return to their starting positions, clear of the work.

The camshaft and crankshaft bearing diameters are finish-bored by carbide-tipped tools held in a right- and a left-hand head at the next working station. These tools operate at a speed of 315 surface feet per minute. After the workpieces are unclamped and lowered, they are unloaded from the machine. During the machining

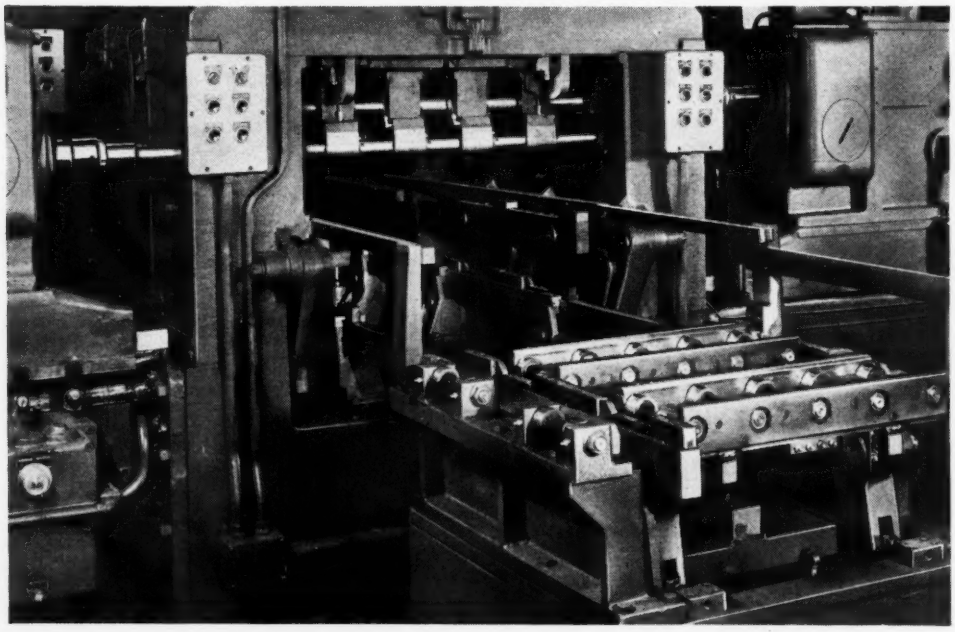


Fig. 3. Loading Station with Engine Blocks Removed to Show Details of the Transfer and Clamping Mechanism. Bushings for Supporting the Boring Spindles can be Seen at Top Center of Machining Station at the Rear

cycle, the operator can load another pair of blocks and, by pressing a cycle button, preset the machine for starting the next cycle. Thus the machine operates continuously, and there is no loss of time for loading and unloading. Each head of the machine is arranged with an adjustable feed control.

A slat conveyor running beneath the machine, along its 17-foot length, removes chips from each machining station and empties them into a flight conveyor, which carries the chips to a tote box. All the major parts of this machine are automatically lubricated, and each head has an individual lubricating pump. A built-in timer insures the delivery of a measured amount of lubricant, at proper intervals, to each bearing and way. The bushings in which the boring-bars rotate are lubricated with fine engine oil by a separate system. An interlocking system of electrical controls protects all movements during each cycle of the machine. It also insures proper locating and clamping of the work-pieces. Lights on the control panel immediately indicate improper functioning of any part of the machine.

Machine Tool Distributors Hold Successful Meeting in Chicago

THE twenty-third spring meeting of the American Machine Tool Distributors' Association, held at the Edgewater Beach Hotel, Chicago, Ill., toward the end of March, was noteworthy for the many different subjects of interest to machine tool distributors that were covered. Apart from the executive sessions, mainly concerned with reports of various officers and committees, there were two general sessions dealing with the problems of the machine tool industry in general. R. L. Giebel, chairman of the Committee on Surplus Property, gave a comprehensive review of the present situation. It was advocated that the Government should keep more machine tools in its possession for eventual future use. It was also suggested that more of the surplus be given to trade and engineering schools that can make good use of modern machine tool equipment.

An excellent address was made by George J. Keller, chairman of the Sales and Service Committee, who dealt with sales and service problems of the distributor. Equally interesting and useful was the address made by H. L. Tigges, chairman of the Sales and Service Committee of the National Machine Tool Builders' Association, who spoke on sales and service problems of the builder.

The outlook for the machine tool industry was covered in an address by Herbert H. Pease, president of the National Machine Tool Builders' Association. Among the points discussed in his address, Mr. Pease advocated tax reform with regard to depreciation allowances, in order to stimulate the equipping of plants with modern machine tools. The coming Machine Tool Show in Chicago was dealt with in addresses by Tell Berna, general manager of the National Machine Tool Builders' Association, by George L. Deane of the Federal Machinery Sales Co., and by A. B. Einig, chairman of the Machine Tool Congress Committee.

At an informal dinner held in connection with the meeting, Burnham Finney, editor of the *American Machinist*, gave an address entitled "One World: Mechanized," which emphasized the necessity for a broader conception of world economy and world competition.

* * *

New Enamels Developed for Severe Operating Conditions

When antimony and zirconium enamels became scarce during the war, the Westinghouse Electric Corporation made a search for other finishes suitable for the exterior of electric appliances subjected to high temperatures. From that search came a titanium-base enamel that also provides an acid-resistant and shock-resistant finish. Since the color of this enamel does not vary with its thickness, when repairs are to be made, the color-matching problem is simplified.

Another enamel, of the aluminum-oxide type, which was developed to prevent excessive corrosion of exhaust manifolds of engines in airplanes and tanks, is also finding peacetime application. It is being used on panels and heating ovens of electric furnaces, where it is able to withstand 200 degrees F. higher temperatures than the zirconium type enamels previously used. This allows the heating coils to be made smaller and to be held closer to dimensions.

Engineering News

Gas-Turbine Generator Set of 2000-H.P. Output

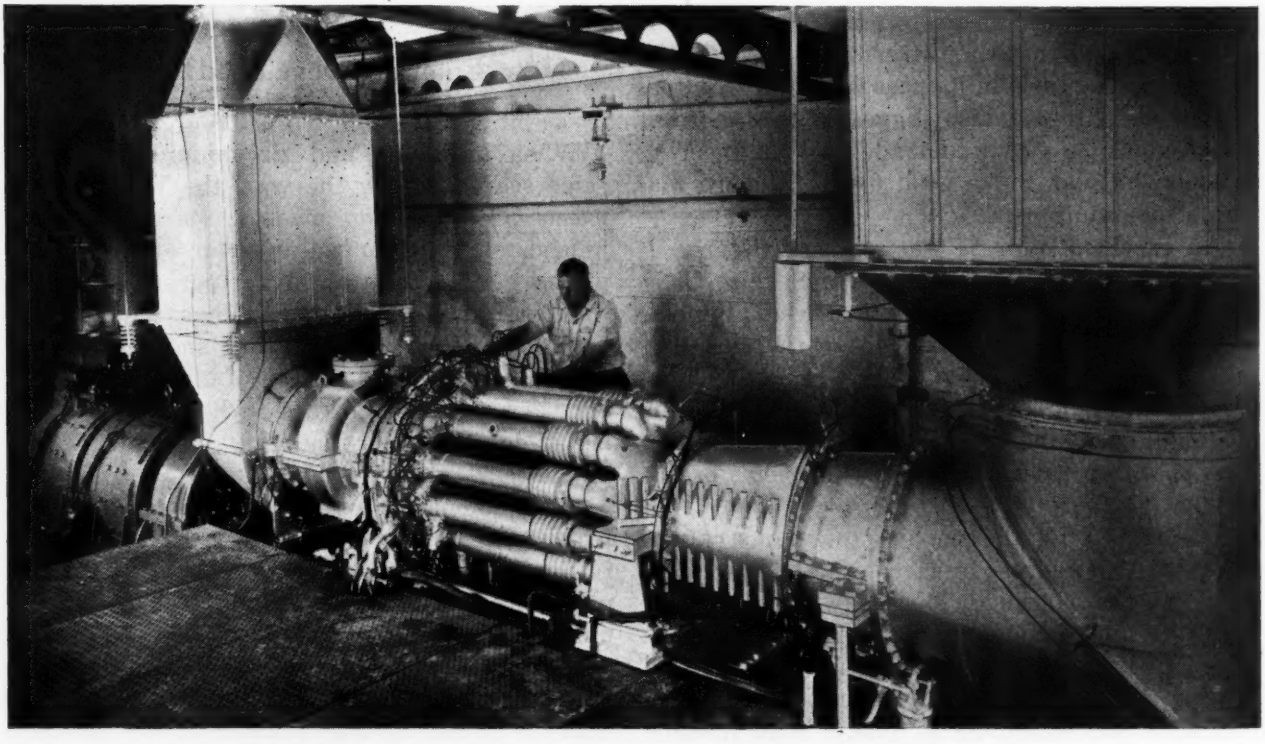
An experimental 2000-H.P. gas-turbine generator set that weighs only 19 pounds per horsepower and starts in 1 1/2 minutes or less has been developed for industrial, central station, marine, and locomotive applications. This equipment occupies only 1/4 cubic foot per horsepower. Its light weight, compactness, and quick starting and loading response make possible a gas-turbine-electric locomotive less than half the length and only two-thirds the weight of its equivalent in a Diesel-electric locomotive. This new development was described by Thomas J. Putz, manager of the Gas and Turbine Section, Steam Division, Westinghouse Electric Corporation, in a paper presented before the American Society of Mechanical Engineers.

In the operation of this gas-turbine generator, air is taken in by the compressor through the inlet metering nozzle and silencer, and is compressed to pressures of from 30 to 75 pounds per square inch absolute, depending on the load carried. Fuel oil is mixed with the compressed air and burned in the combustors. The amount of fuel burned is controlled so as to limit the temperature of the gases to between 700 and 1350 degrees F. at the combustion chamber outlets. The hot gases are expanded through the power producing turbine and the resultant exhaust gases pass through a diffuser, elbow, and silencer to the atmosphere.

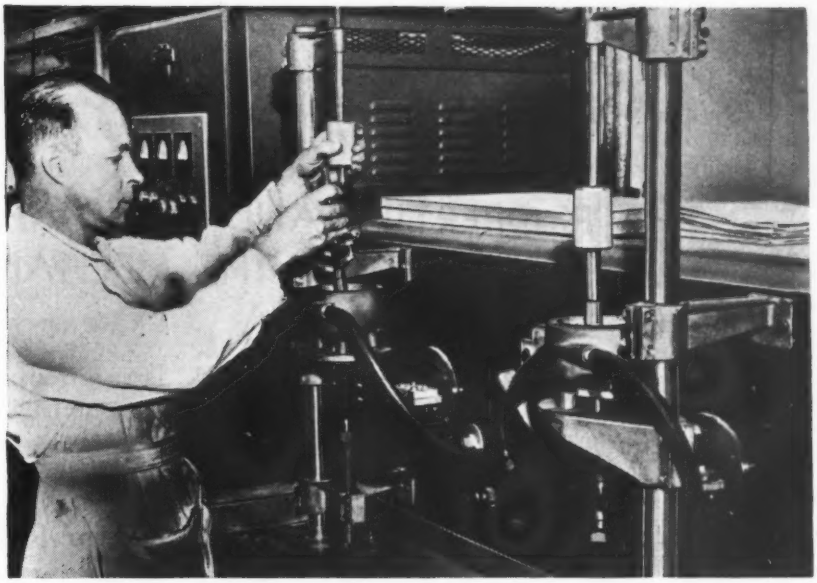
The turbine develops about 6000 H.P., of which 4000 H.P. is employed to drive the compressor. The remaining 2000 H.P. is the useful output delivered to the direct-current generator. The full-load speed of the turbine and compressor is 9200 R.P.M., while the generator speed is 1200 R.P.M.

Spectrophotometer Used to Match Color Samples

A recording photo-electric spectrophotometer which can measure over 2,000,000 shades of color and record them as curves on a graph is now in use at Pemco Corporation, Baltimore, Md., to simplify the matching of porcelain enamel and glass colors and to provide a constant quality control. This instrument, which



Gas-turbine Generator Set of 2000-H.P. Capacity on Test at the South Philadelphia Works of the Westinghouse Electric Corporation



The Crankshaft of a Small Gasoline Engine Manufactured by McCulloch Motors Corporation, Los Angeles, Calif., is here being Placed in a Thermonic Induction Heater for Casehardening. The Shaft is Automatically Quenched, after Heating, by Oil Sprayed from the Head Surrounding It

was made by the General Electric Co., is expected to save from two-thirds to three-fourths of the time formerly needed to match colors by visual comparison. The latter method was difficult and often inaccurate because under certain lighting conditions two colors appeared matched to one person and mismatched to another.

Operation of the spectrophotometer is simple, consisting merely of inserting a color sample and a color standard in their respective holders, placing recording paper on a drum of the instrument, and selecting the correct operating speed.

Projection Method of Testing Photographic Lenses

A projection method of testing photographic lenses to insure a precise control of quality has recently been developed by the Bausch & Lomb Optical Co. This method involves the use of an instrument that functions like a movie projector except that the image which it throws on a screen remains stationary. This image is magnified hundreds of times, depending on the distance of the projector from the screen and the focal length of the lens.

A target, imprinted with a series of minute replicas of a testing chart, provides the image which is projected through the lens being tested and on the screen. Each chart is so placed on the target that the entire image field, from the center to the extreme outer edges of the lens, may be examined for all types of aberrations. Magnification is selected to meet the specific standards required of the lens. For example, a microscopic chart no larger than the head of a pin may be magnified 240 times for one type of lens, 300 times for another, and so on.

Rubber Insulators Applied to Heavy Foundry Equipment

Rubber insulators that isolate vibrations of jolt machines used in the production of sand molds in foundries have been developed by engineers of the United States Rubber Co. and installed in the new aircraft engine plant of the Wright Aeronautical Corporation, Wood-Ridge, N. J. The insulators are used in mounting thirteen machines weighing from 3000 to 22,000 pounds. The machines are secured to huge concrete blocks which rest on the rubber mountings. The rubber isolates shock so completely that sensitive instruments in a research laboratory less than 50 yards from the machines can be operated without interference. Thus, all thirteen machines in the plant can be operated in unison without setting up vibratons in surrounding areas.

Ford Adds Mobile X-Ray to Check Employe Health

A mobile X-ray unit, manned by four trained technicians, has been put into service at the Ford Motor Co.'s Rouge plant to X-ray the chests of employes and thus help to reduce respiratory ailments. The unit is housed in a specially built trailer and is moved from department to department at regular intervals. Besides the portable X-ray unit, the company has also inaugurated a rehabilitation program that insures suitable employment for men recovering from an illness and for those workers with disabilities or allergies. Four inspectors tour the Rouge plant seeking assignments for employes who have physical deficiencies.

Materials of Industry

THE PROPERTIES AND NEW APPLICATIONS OF MATERIALS USED IN THE MECHANICAL INDUSTRIES

High-Temperature Resistant Plastic Has Many Electrical Applications

"Teflon" tetrafluoroethylene resin, the new du Pont plastic that is unharmed by temperatures up to 575 degrees F. and withstands every known solvent, is believed to be the solution to many long-standing problems in the electrical equipment field. This plastic is already being used for a wide variety of electrical insulators and related parts, and thin tapes of Teflon are being tested as primary insulation and as a material for slot liners.

The new plastic surpasses polystyrene and polythene, both of which have favorable electric properties, and has an extremely low dielectric loss factor even at frequencies up to 3000 megacycles.

Films of Teflon can be flexed without cracking at temperatures as low as —148 degrees F. The water absorption rate of this plastic is given as zero. It has high impact strength and toughness, which extend its field of usefulness.

In addition to its promising future in the electrical field, Teflon is being widely used as a gasket material when resistance to heat or corrosion is required. It is being employed for diaphragms for pumps and valves and as a packing material for valves. 201

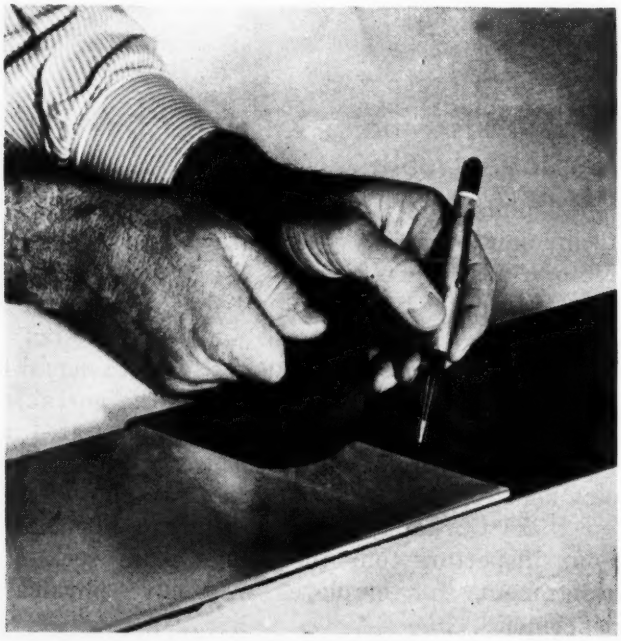
Water Repellent Keeps Oil-Meter Windows Clear

General Electric Co., Pittsfield, Mass., has found in recent tests that 100,000 gallons of crude oil, passing through an area type flow meter in a ten-day period, failed to affect the glass surface of the meter window when treated with G-E "Dri-Film." This is in contrast to the weekly cleaning operations previously required when the window surface was untreated. The Dri-Film water-repellent material was applied to the glass surface simply by wiping with a cloth followed by polishing with a dry cloth..202

Liquid Compound Builds Up ¼-Inch Coating in Single Dip

A rack insulator and protective coating that builds up to from 1/16 to 1/4 inch in thickness in a single dip has been announced recently by the U. S. Stoneware Co., Akron, Ohio. The coating, known as "Tygoflex Rack Coating," is based on a new Tygon resin formulation. When applied by the usual techniques of dipping, spraying, brushing, etc., and subsequently subjected to heat for a very short period, Tygoflex converts to a thick, impermeable insulator, resembling in appearance and physical characteristics a glossy black rubber compound of medium hardness.

The coating will resist the action of all plating-acid or alkaline solutions at temperatures up to 250 degrees F. for an unlimited time. It is unaffected by abrupt temperature changes, such as take place when a boiling cleaner is replaced by a cold rinse. 203



A Corrosion-resistant Liquid Compound, Known as "Tygoflex," for Protecting Process Equipment Contains No Volatiles and can be Applied in Thicknesses up to 1/4 Inch in a Single Dip

Nickel-Clad and Monel-Clad Steel Strip Produced

The development of rolled nickel-clad and Monel-clad steel strip was recently announced by the Superior Steel Corporation, Carnegie, Pa. Depending on requirements, the strip is furnished with nickel or Monel cladding on one side only or on both sides. The standard cladding thickness is 10 per cent of the total thickness of the strip for each side. The cladding cannot be separated from the steel base except by chemically dissolving out the steel. The strip can be stamped, drawn, spun, bent, spot-welded, or otherwise fabricated with no more difficulty than if low-carbon deep-drawing steels were used.

Because the thermal coefficients of expansion of nickel, Monel, and steel are nearly the same, there is little danger of warping or twisting in applications where appreciable temperature changes are encountered.

The strip is being manufactured in the cold-rolled condition in thicknesses of between 0.010 and 0.125 inch and in the hot-rolled condition between 0.095 and 0.250 inch, in widths of from 1/4 inch to 10 1/4 inches. 204

Emulsifying Agent for Use with Petroleum Cleaning Agents

A new emulsifying agent, known as "Mulsirex," is designed for use with kerosene and other petroleum cleaning agents to insure greater safety, efficiency, and economy. This product, developed by Turco Products, Inc., 6135 S. Central Ave., Los Angeles 1, Calif., is recommended for removing very heavy deposits of oil and light grease from all kinds of metal parts and equipment. In solution with petroleum cleaning agents, Mulsirex adds to the cleaning potency of these agents and at the same time, because of its high flash point (180 degrees F.), greatly increases the margin of safety for the operator. The emulsifying characteristics of this product make foreign substances readily soluble in water, a feature that permits the deposits to be flushed away with a simple cold water rinse after application of the cleaning agent. 205

Grain Cement and Thinner for Polishing Wheels

The Hanson-Van Winkle-Munning Co., Matawan, N. J., has announced a new grain cement and thinner which serves as an improved adhesive for polishing wheels and overcomes the deficiencies of organic glues. It has been used successfully for a number of months. 206

Dyes for Mixing with Plastic Injection-Molding Powders

Powder dyes that can be used to color molding powders, giving a clear and transparent color effect, have been developed by the Krieger Color & Chemical Co., 6531 Santa Monica Blvd., Hollywood 38, Calif. The new products, known as "Poly Supra Concentrate Molding Powder Dyes," can be used with cellulose acetate, polystyrene, Lucite, Plexiglas, and vinyl molding powders. Light shades are produced by adding as little as 1/2 ounce and medium shades by adding as little as 1 ounce of the powder dye to 26 pounds of molding powder. These new dyes are available in red, royal blue, blue-green, orange, amber, purple, black, and yellow. All the colors can be intermixed. 207

To Obtain Additional Information on Materials of Industry

To obtain additional information about any of the materials described on these pages, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning name of material as described in May, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

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Spring Meeting of Machine Tool Builders

THE Machine Tool Show to be held in Chicago next September, Government policies of especial interest to the machine tool industry, and domestic and overseas markets were the principal subjects discussed at the spring meeting of the National Machine Tool Builders' Association, held in Atlantic City April 14 to 16. Tell Berna, general manager of the Association, pointed out that the Machine Tool Shows are the most effective way that the industry has found to sell machine tools. He stated that we are in the midst of a revolution in the technology of agriculture, industry, and transportation, that there are tremendous opportunities for modernization and expansion, and that new ways of improving man's economic well-being are presenting themselves almost daily.

Mr. Berna believes that, in this situation, the machine tool plays a role of fundamental importance, which lends emphasis to the value and timeliness of the Machine Tool Show. He feels that the show is a "must" for every machine shop executive in the world and that it will demonstrate the optimism, resourcefulness, and outstanding technical superiority of the United States machine tool industry.

In his address "Government Policy and the Machine Tool Industry," James Y. Scott, president of the Van Norman Co., suggested that Government-owned machine tools for which there is no commercial demand should be made available to schools more readily and at less cost than is now the case. "The present procedure," Mr. Scott said, "is not only complex, but the price of 5 per cent of the fair market value is still more money than schools can pay." It has been recommended that such machines be offered to schools at $1 each.

Mr. Scott also mentioned that a recommendation had been made to the administrator of the War Assets Administration that the sale of surplus machine tools abroad be abandoned as offering no contribution of any value to the solution of the surplus machine tool problem and as constituting an extremely serious risk to the future of the machine tool industry. It was pointed out that it was not in the interests of the nation to have the good name of an industry, built up over years of efforts in foreign fields, destroyed by shipping abroad machines that are in questionable condition and that may not even turn out to be the type the buyer expected to get.

Present-day difficulties in selling machine tools overseas were outlined by A. S. Keller, vice-president, Pratt & Whitney, while Herbert L. Tigges, vice-president and general manager, Baker Brothers, Inc., also discussed selling problems in his paper "Better Selling."

Erik Oberg, consulting editor of MACHINERY, reported his impressions on industrial conditions in Central Europe gained during a tour of Germany, Austria, Italy, and France as a member of a group of journalists who recently made the tour under the auspices of the Secretary of War.

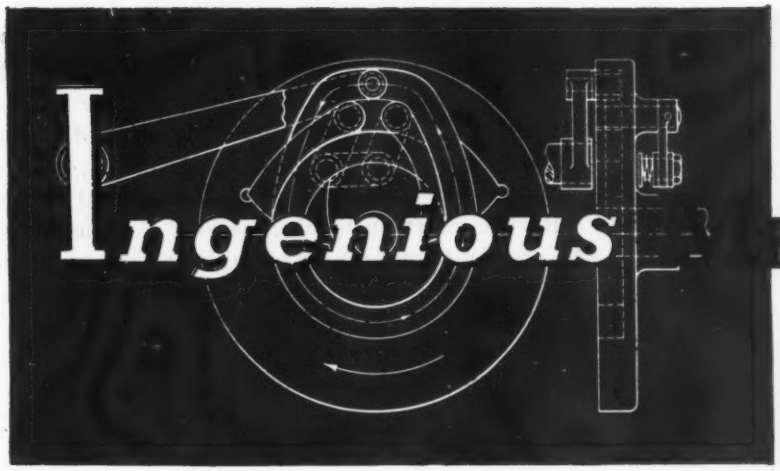
"Public Relations and the Machine Tool Industry" was the subject of a talk by William L. Dolle, president of the Lodge & Shipley Co. Another paper, presented before the meeting by Frederick S. Blackall, Jr., president of the Taft-Peirce Mfg. Co., dealt with "The New Tax Outlook." Swan E. Bergstrom, sales manager, Cincinnati Milling Machine Co., discussed plans for the Machine Tool Show. The speaker at the annual dinner was Dr. Alan Valentine, president of the University of Rochester, who spoke on private enterprise in higher education.

Peacetime Applications of Atomic Energy

Construction of the $100,000 display of atomic energy in action which will be the central theme of the 1947 Mid-American Exposition in the Cleveland Public Auditorium May 22 to 31 is being completed with the full cooperation of the United States Atomic Energy Commission and of the industries that had a part in the $2,000,000,000 research that resulted in the war-time atomic bomb.

The Cleveland display will show peacetime applications of the development, and the atom will actually be split at the exposition through the use of a special model of the machine created by Dr. John R. Dunning, who, with his colleagues, made history when he split U-235 with the Columbia University cyclotron.

For the first time, the general public will be able to see nuclear fission at work, as models of locomotives and factory equipment will be operated by simulated atomic action. Many other examples of the use of atomic energy will be on display in the 10,000 square foot exhibit.



Ingenious MECHANISMS

Mechanisms Selected by Experienced Machine Designers as Typical Examples Applicable in the Construction of Automatic Machines and other Devices

Mechanism for Imparting Oscillating Motion to Paper-Cutting Blade

By CHARLES F. SMITH

Paper sheets are rapidly cut into strips by means of equipment designed as shown in Fig. 1. The modified oscillating motion imparted to the cutter by this design was found to be much more suitable for cutting paper than the action of a vertical guillotine type of cutter. The width of the strip is adjustable by 1/2 inch increments, and as many as four hundred strips have been cut per minute.

The paper-cutting blade *A*, Fig. 2, is clamped in holder *B*, which is mounted on shaft *C*. This shaft is held in the eccentric bushings *D*, which are rotated through gears *E*, *F*, and *G* by the main driven gear *H*, Fig. 1. The paper is cut against a hardened and ground anvil roll *J*, the pressure between the roll and the paper and cutting blade being adjustable by means of the screws *K* and springs *L*. This anvil roll is driven by gear *M*, which, in turn, is driven by change-gears (not shown). The change-gears also drive the paper feed rolls, thus permitting adjustment of the width of strip to be cut.

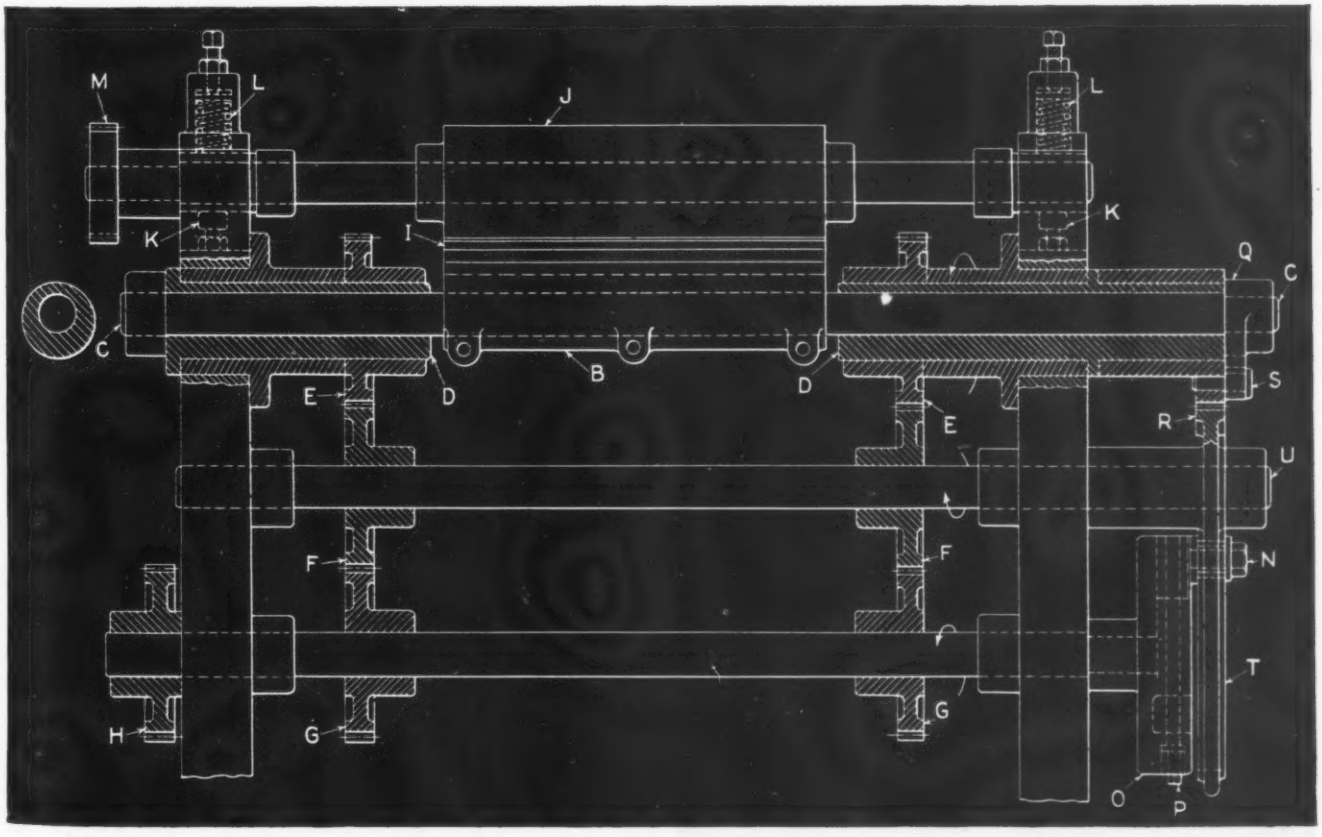


Fig. 1. Mechanism that Imparts Modified Oscillating Motion to Paper-cutting Blade

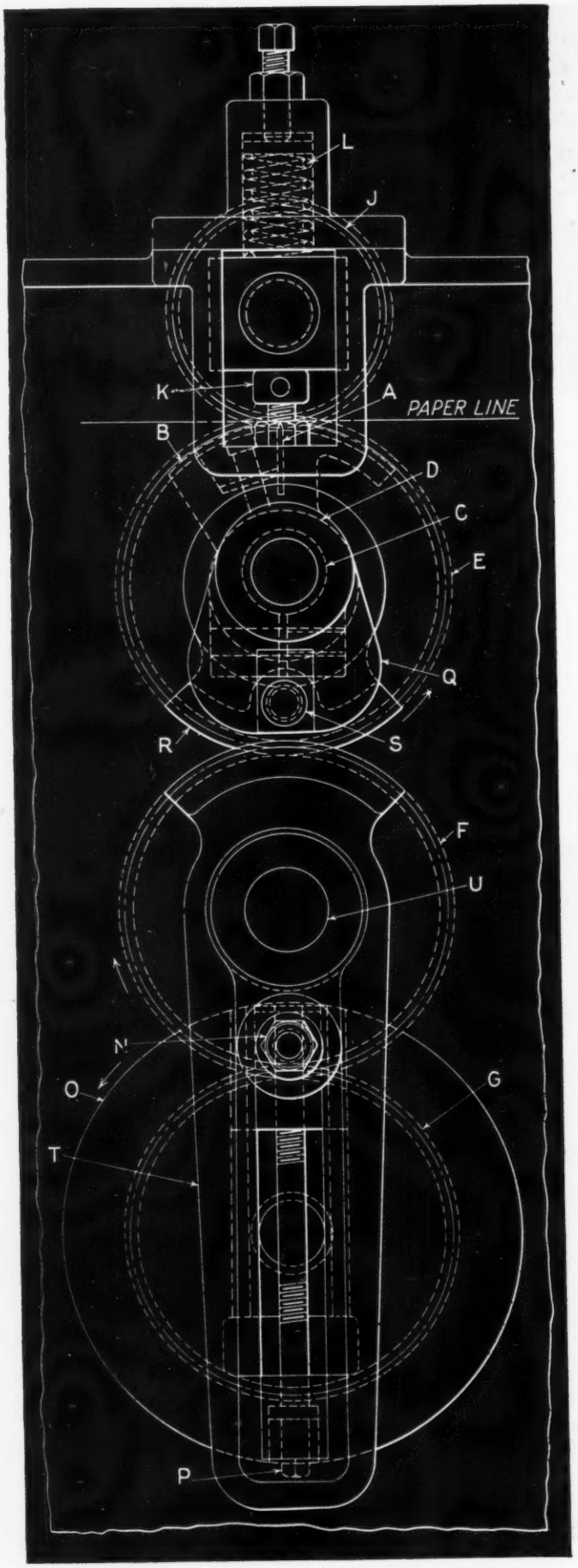


Fig. 2. Enlarged End View of Mechanism Shown in Fig. 1

Shaft *C*, on which the paper-cutting blade and holder are mounted, is moved up and down by the rotation of the eccentric bushings *D*. The paper-cutting blade is kept in an upright position by fork *Q* (see Fig. 2), which is pinned to shaft *C* and slides up and down with the shaft on block *S*. Block *S* is fastened to segment gear *R* by a stud. Segment gear *R*, which is a sliding fit on eccentric bushing *D*, imparts an oscillating motion to the paper-cutting blade through the stud, block *S*, fork *Q*, shaft *C*, and holder *B*. Segment gear *R* is oscillated by the segment gear on slotted arm *T*.

Slotted arm *T*, which is a sliding fit on shaft *U*, is reciprocated about this shaft by crank *N*. The position of crank *N* is adjustable in disk *O* by means of screw *P* to synchronize the speed with which the paper-cutting blade travels on its modified oscillating path, with the rotary speed of the anvil roll *J*.

* * *

Management Course at University of Iowa

The ninth management course offered by the University of Iowa is to be held this year from June 9 to 17. This course is designed primarily for people in industry who want comprehensive training in production planning, job evaluation, time and motion study, wage incentives, and related subjects. It combines fundamental training with practical applications. Attention will also be given to procedures to be followed in conducting factory training programs.

Further information can be obtained from Ralph M. Barnes, College of Engineering, State University of Iowa, Iowa City.

* * *

Communists Within the Labor Movement

A booklet entitled "Communists Within the Labor Movement" has been prepared by the U. S. Chamber of Commerce to inform business executives, including persons in charge of industrial relations and personnel matters, of the facts concerning communist activities in labor unions, and to suggest methods of coping with this problem. Single copies are available at 50 cents, and larger quantities at reduced prices. Further information can be obtained from the Economic Research Department, Chamber of Commerce, Washington 6, D. C.

Tool Engineering Ideas

Tools and Fixtures of Unusual Design, and Time- and Labor-Saving Methods that Have been Found Useful by Men Engaged in Tool Design and Shop Work

Automatically Burring Grooved and Drilled Cylindrical Parts

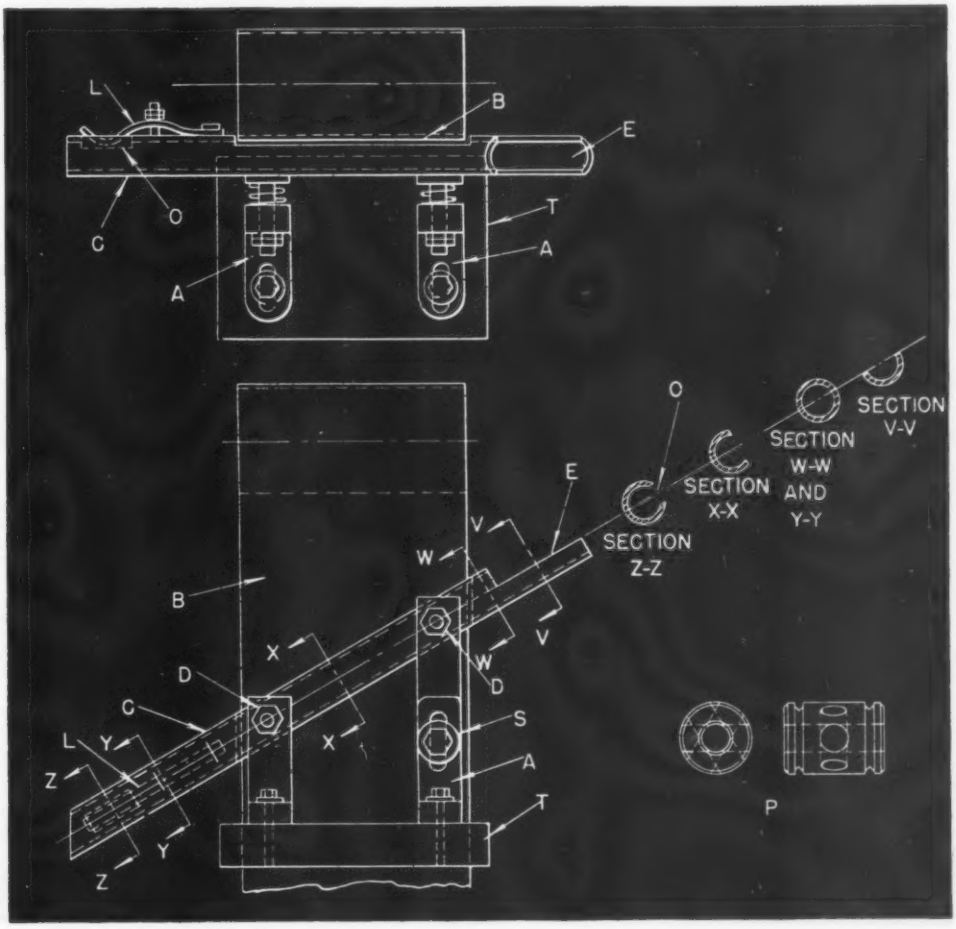
By MARK W. PURSER, Tenafly, N. J.

Burrs can be automatically removed from radial holes and annular grooves on the outside diameter of small cylindrical parts, such as shown at *P* in the illustration, by means of the belt-sanding machine attachment here illustrated. This device was developed by the Farmingdale Aircraftsmen Mfg. Corporation, Farmingdale, N. Y.

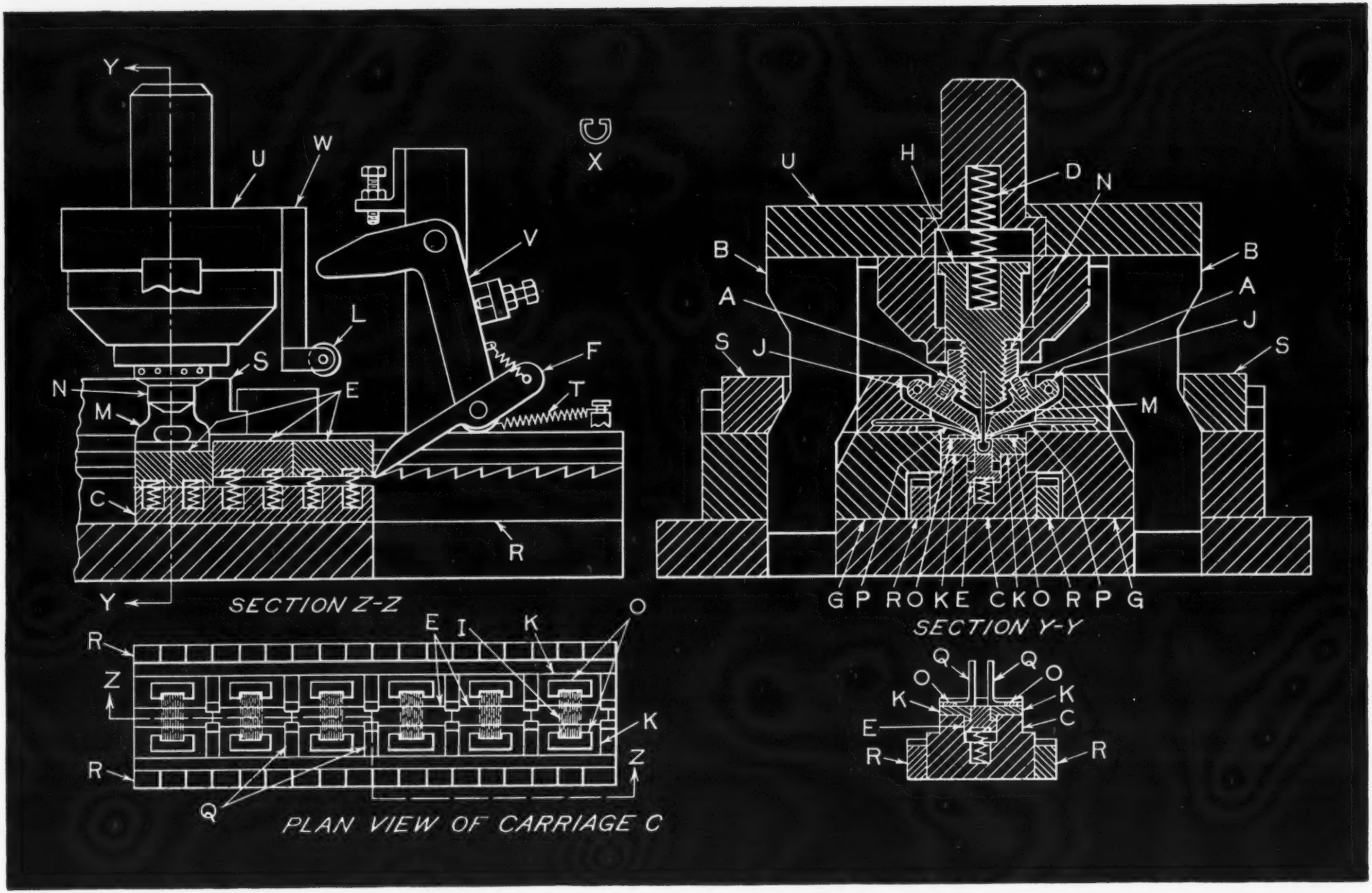
The parts are fed in the upper end *E* of chute *C*, and fall down past emery belt *B* of the sanding machine. The chute consists of a tube which is open along the part of its length that is adjacent to the emery belt. This permits the parts, as they travel down the chute, to be rotated by the revolving belt and automatically abraded on their outer periphery. Cross-sections of the tubular chute at various positions along its length are shown at *V–V*, *W–W*, *X–X*, *Y–Y*, and *Z–Z*.

The chute is held firmly to table *T* of the sanding machine by angle-iron brackets *A*. The inclination of the chute can be varied by adjusting the position of stud *S* in the slot of the angle-iron. The pressure with which the parts are held against the belt can also be adjusted by tightening or loosening screws *D*, on which helical springs are mounted.

The tension of leaf spring *L* can be adjusted to control the discharge rate of the work-pieces. This leaf spring contacts the parts through the opening *O* in the chute. The lower end of the chute is open to permit discharge of parts.



Attachment Developed for Automatically Burring the Outside Diameter of Drilled and Grooved Cylindrical Parts, Such as Shown at P, on a Belt-sanding Machine



Fine Wire Rings Such as the One Shown at X Are Formed at the Rate of 120,000 per Day by Means of This Die

High-Production Die for Forming Fine Wires into Ring-Shaped Parts

By L. SEGALLE, Bucharest, Roumania

Fine wires, 3/4 inch long, with a diameter of 0.020 to 0.063 inch, are formed into small rings, such as shown at *X* in the accompanying illustration, at a production rate of 120,000 per day by means of the die shown.

Ten wires, cut to length, are placed between each of the six pairs of stock guides *O* on carriage *C*, as shown by dotted lines at *I* in the plan view of the carriage. The loaded carriage is inserted between the guides *G*, as shown in section *Y–Y*, until the left-hand pair of stock guides is centered below the bending mandrel *M*.

As the press ram descends, the bending mandrel *M*, advanced by spring *D*, forces the wires into a U-shape in bending jaws *K*. Simultaneously, slides *S* and the pivoted members *J* are advanced toward the center of the die by the descent of cam bars *B*, which are attached to the upper plate of the die *U* and thus travel with the ram. Pins *A*, which are threaded into the upper surfaces of members *J*, contact the conical face of the nut *N*, which is threaded to the mandrel-holder *H*, and thus bend the flat springs *P*. The edges of these springs come in contact with the ends of the U-shaped wires and force them around the bending mandrel, forming the wires to the shape shown at *X* in the illustration.

Brackets *W* (see section *Z–Z*), to which rollers *L* are attached, are fastened to the upper plate of the die *U*. On the down stroke of the press ram, the rollers pivot the bellcrank levers *V*, thus moving pawls *F* to the right, where they are held by the action of springs *T*. On the up stroke, the rollers pivot the bellcranks in the other direction, and the pawls are moved to the left, indexing the carriage, by means of racks *R*, to bring the next group of wires into the forming position.

As the ram rises, the bending mandrel *M*, members *J*, and flat springs *P* are withdrawn. The formed wire rings are removed from the mandrel by a pair of strippers *Q* and ejectors *E* when the carriage advances. The distance between these strippers closely approximates the diameter of the mandrel.

A second carriage can be loaded while the wires in the first carriage are being formed. Various wire diameters, within the capacity of the die, can be formed about the same mandrel by simply changing the bending jaws *K* to suit the size of work to be handled.

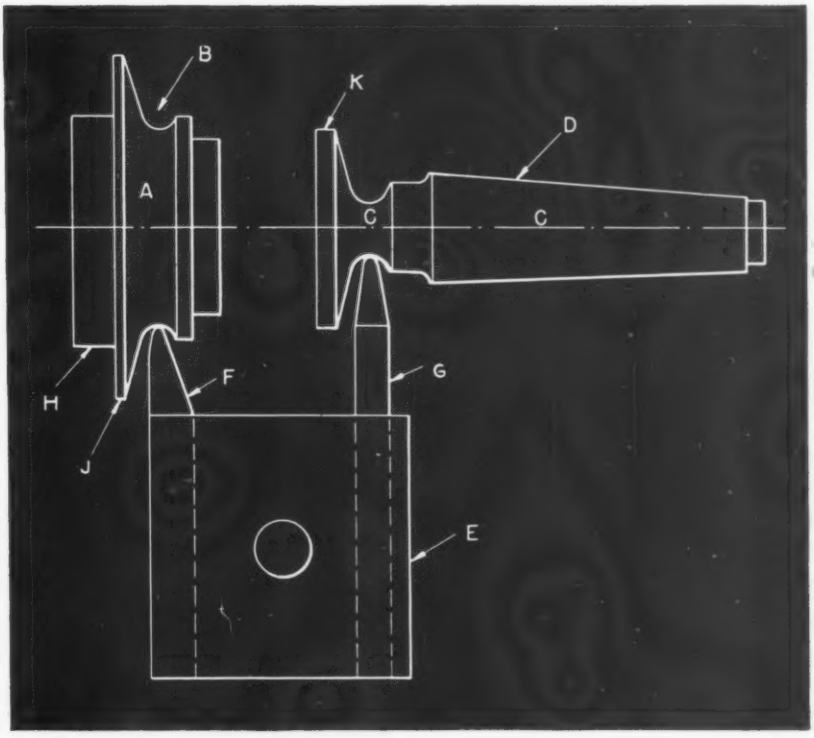
Contour-Turning a Bronze Engine Part by the Use of a Master Form

By DONALD A. BAKER, Boonton, N. J.

The bronze engine part *A* shown in the accompanying illustration was to be finished all over, including the angles and radius *B*. Machining the part with a form tool was not successful, so it was decided to turn it by the use of an angle-point tool in the following manner:

First, a master form was made as shown at *C;* the taper *D* was turned to fit into the tailstock of the lathe on which the parts were to be made. A tool-block *E* was then fastened to the compound rest of the lathe and into this was secured a tool bit *F* and a brass rod *G*, both similarly shaped on their ends so as to accurately duplicate the master form contour.

When the work was chucked on shoulder *H*, the tool set to diameter *J*, and the follower pin to diameter *K*, it was an easy matter to finish the part to the desired shape.



Machining the Contour of a Part on a Lathe by Means of a Master Form

High-Voltage Spark Replaces Mechanical Drilling of Diamond Dies

AN electrical method developed at the National Bureau of Standards for drilling small diamond dies is said to eliminate almost one hundred man-hours of labor from older mechanical processes. This discovery has completely revolutionized the fine-wire diamond die industry.

Essentially, the method consists of drilling the primary cone by three separate applications of a high-voltage spark, followed each time by mechanical coning; the secondary, or shaping cone, is then drilled by dipping the die in an electrolytic solution and passing low-voltage current through its face.

The primary cone is drilled by means of high-voltage sparks formed at the point of a needle electrode in contact with the face of the diamond. When rising voltage is applied to the circuit, a discharge occurs across the face of the diamond between the needle electrode and the brass block on which the diamond is mounted. The rate of drilling increases with the power input into the circuit until a limit is reached where the temperature of the diamond is too high and its surface takes on a frosty appearance. The drilling needle, which is 0.02 inch in diameter, becomes red-hot at its tip before this "frosting" point is reached, and the reddening point of the electrode is used as a criterion in adjusting the power input to the circuit.

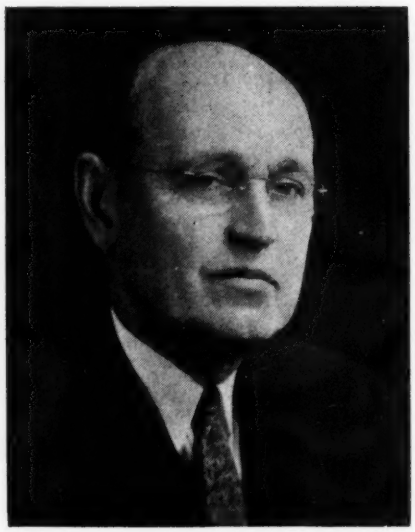
The secondary cone is formed by the action of a low-voltage spark in an electrolytic solution. The diamond is mounted on an insulating post in a shallow glass dish, and enough of the electrolyte is used to fill the dish and just cover the diamond. The "drilling" electrode is a platinum-iridium needle, which is lowered into contact with the bottom of the primary cone and rests with very light pressure (about one-fifth of a gram) on the diamond. A second electrode dips into the solution at some distance from the diamond.

When a low voltage (around 90 volts) is applied between the electrodes, sparking occurs at the tip of the drilling needle and a smooth-walled conical hole is formed in the diamond directly under the needle. The shape of the hole and the angle of its walls are controlled by the type of electrolyte used, while the hole size is controlled by the pressure of the needle against the diamond. The power input into the circuit is controlled by the depth of the solution covering the diamond and by the voltage applied.

Electric drilling takes seven to fifteen hours, depending on the type of die, with ten hours as an average. Actual man-hours are considerably less than this, averaging about two man-hours per die, because almost every stage in the process is easily adaptable to multiple production.

W. B. Peirce Elected President of A.S.T.E.

W. B. Peirce, vice-president in charge of research at the Flannery Bolt Co., Bridgeville, Pa., was elected president of the American Society of Tool Engineers at a board of directors' meeting held in Houston, Tex., on March 21. He succeeds A. M. Sargent. Mr. Peirce formerly held the post of first vice-president.



Other officers elected are: I. F. Holland, general superintendent, Small Tool and Gage Department, Pratt & Whitney Division Niles-Bement-Pond Co., Hartford, Conn., first vice-president; R. B. Douglas, industrial engineer, Montreal, Quebec, Canada, second vice-president; George C. Johnson, chief engineer, W. F. and John Barnes Co., Rockford, Ill., third vice-president; and W. A. Dawson, branch manager, F. F. Barber Machinery Co., Hamilton, Ontario, Canada, secretary. Harry E. Conrad of Detroit was re-elected executive secretary.

Shop Equipment News

Machine Tools, Unit Mechanisms, Machine Parts, and Material-Handling Appliances Recently Placed on the Market

Sip Large-Size Precision Jig Boring and Milling Machine

The Cosa Corporation, Chrysler Bldg., New York 17, N. Y., is introducing on the American market a new Sip Hydroptic jig boring and milling machine, developed by Societe Genevoise d'Instruments de Physique, of Geneva, Switzerland, for handling much larger and heavier precision work than could be accommodated on any of preceding machines of this type. The new Hydroptic-7 jig borer is practically a giant-size model of the earlier Sip Hydroptic-B precision jig boring machine. It weighs 24,000 pounds, and has a table with a working surface 62 by 40 1/2 inches, as compared with the 39 1/2- by 32-inch working surface of the table on the Hydroptic-B machine.

Although this new machine is basically the same as the smaller model, it has many new features, such as dual controls on each side of the machine and other advantages not seen in the illustration. Notwithstanding the fact that this heavy machine is intended primarily for specialized operations on exceptionally large work, it has a guaranteed accuracy of 0.0002 inch for all settings of the work-table and spindle head. It embodies the Hydroptic optical measuring system, comprising standard scales of extreme accuracy incorporated in the machine in such a way as to remain unchanged through years of service. The table feed is controlled by a hydraulic system which provides a continuous or stepless range of feeds.

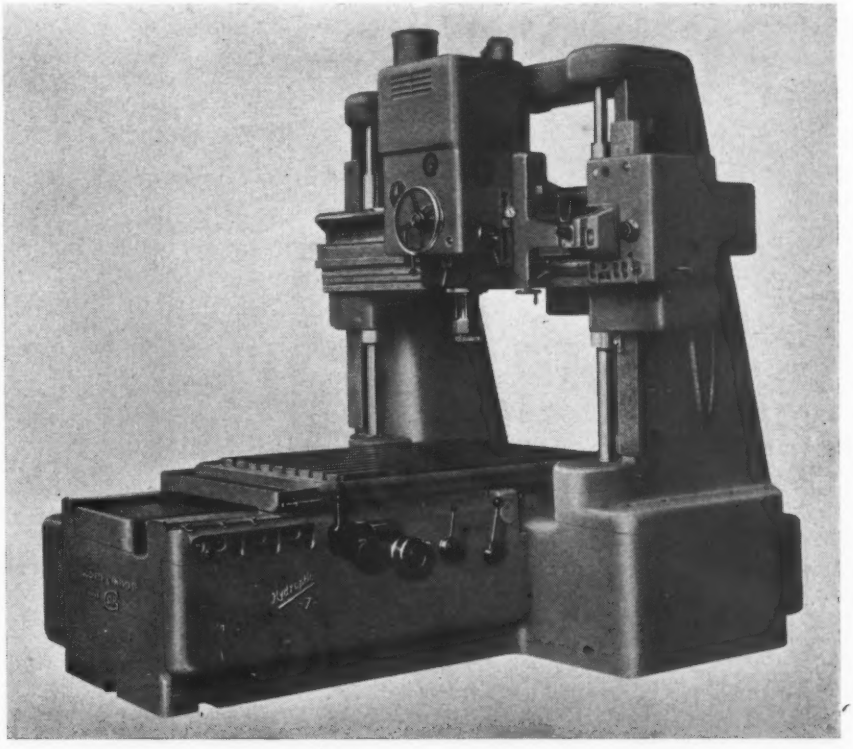
The table of the machine has a longitudinal travel of 55 inches, and the spindle saddle has a transverse travel of 40 inches. The free space between the upright columns is 63 inches, and the maximum distance from the top of the table to the end of the spindle is 37 3/4 inches. Drills up to 2 3/8 inches in diameter can be used for drilling cast iron, and the machine has a capacity for boring holes up to 10 inches in diameter. Surfacing heads having a normal diameter of 6 inches can be used.

The standard scales of the measuring devices have 0.1-inch graduations. The auxiliary scales for rough settings also read to 0.1 inch. Drum readings with the microscope are made to 0.001 inch and vernier readings to 0.0001 inch. The microscopes used for these readings have a magnification power of 45X.

The work-table has ten 5/8-inch wide T-slots, and its working surface is 36 1/2 inches from the floor. It has a hydraulically operated travel of 52 inches and a hand setting motion of 4 inches. The feed per revolution of the table-setting handwheel is 0.0055 inch. Power feed for making fine settings is at the rate of 0.0017 inch per second. Hydraulic milling feeds range up to 12 inches per minute, and hydraulic rapid traverse of the table is at the rate of 90 to 110 inches per minute.

The spindle saddle has a feed of 0.025 inch per revolution of the slow-motion handwheel, and a feed of 0.02 inch per revolution of the fine setting knob. Power milling feeds of the spindle saddle are at the rate of 1.2, 2.4, 3.6, and 7.2 inches per minute, and the power rapid traverse is at the rate of 70 inches per minute.

The spindle is of the special Sip internal taper design. The spindle quill is 4 3/4 inches in diameter and has a travel of 12 inches. One revolution of the slow-motion handwheel gives the spindle quill a travel of 0.15 inch, and one revolution of the main handwheel gives it a travel of 6 3/4 inches.



Sip Hydroptic Jig Boring and Milling Machine

To obtain additional information on equipment described on this page, see lower part of page 218.

The power traversing quill speed is at the rate of 1 inch per second. There are eighteen spindle speeds ranging from 40 to 2000 R.P.M., and eight spindle feeds, up and down, ranging from 0.0005 to 0.012 inch. Slow spindle speeds for setting purposes are at the rate of 5, 6, and 7 1/2 R.P.M. The built-in depth measuring device has a range of 12 inches, the dial indicator reading to 0.0005 inch.

The machine is 164 by 104 by 132 inches in size. It is completely wired for an alternating-current three-phase 380-volt circuit, and is equipped with a two-speed spindle driving motor of 3 to 4 H.P. Auxiliary motors and coolant pump unit, starters and safety devices, and remote control of the work-spindle from either side of the bed and from the cross-rail are included in the regular equipment. The high-precision Rotoptic optical dividing head described in December, 1946, MACHINERY, is available for mounting on the table of this new machine. 61

Bryant Automatic Precision Small-Bore Grinding Machine

The Bryant Chucking Grinder Co., Springfield, Vt., has brought out an automatic internal grinder designed for the high-production precision grinding of small bores, from 1/4 inch to 3 inches in diameter and up to 4 inches deep. The grinder will swing work up to 9 inches in diameter, and is suitable for grinding operations on ball-bearing races, gears, rolls, bushings, and other small parts produced in large quantities. The most important feature of this new machine is the hydraulic and electronic control arrangement, which provides for completely selective, infinitely variable cycles. This equipment permits every grinding and truing operation to be timed to a split second, and thus serves to reduce idle time to a minimum.

The machine is so designed that the full grinding cycle proceeds automatically, the operator only being required to load and unload the work and trip the valve to start the cycle. The automatic cycle includes rough-grinding, wheel-truing, finish-grinding, and return to the chucking position.

Many new features have been incorporated in the design of this No. 109 machine to assure maximum production and extreme precision. Basically, the Bryant principle of cylindrical slide construction has been retained. Both longitudinal and cross slides are mounted in preloaded ball bearings. Thus accurate control and freedom of motion of the slides is assured, and grinding loads are transmitted directly to the base of the machine.

An infinite number of feeds and speeds have been made available for the cross-feed and the work-drive spindle by providing direct-current motors and built-in rectifiers to permit the use of standard alternating-current power. The feed controls, shown in Fig. 2, consist of three adjustable cams and five rheostats, employed to provide flexibility of adjustment and to facilitate setting-up operations. The cams actuate limit switches to control the rate of feed obtained by the direct-current motor drive. The rheostats provide independent control of the various movements during the cycle.

In addition to the controls there are two electrical timing devices which can be adjusted to provide a "spark out" period for both rough- and finish-grinding. To further speed up the grinding operation, an adjustable "back-off" stop can be set so that the feed backs off only the amount required.

The main wheel-slide traverse is operated hydraulically, four individual throttles being provided, as shown in Fig. 3, to allow the preselection of the best traverse speeds for quick approach, rough-grinding, wheel-truing, and finish-grinding. A mechanical short-stroking device can be applied when desired. The machine is equipped with the new direct-mounted Bryant high-frequency wheel-head unit. With this drive, wheel speeds up to 100,000 R.P.M. can be obtained. Provision has also been made for a balanced

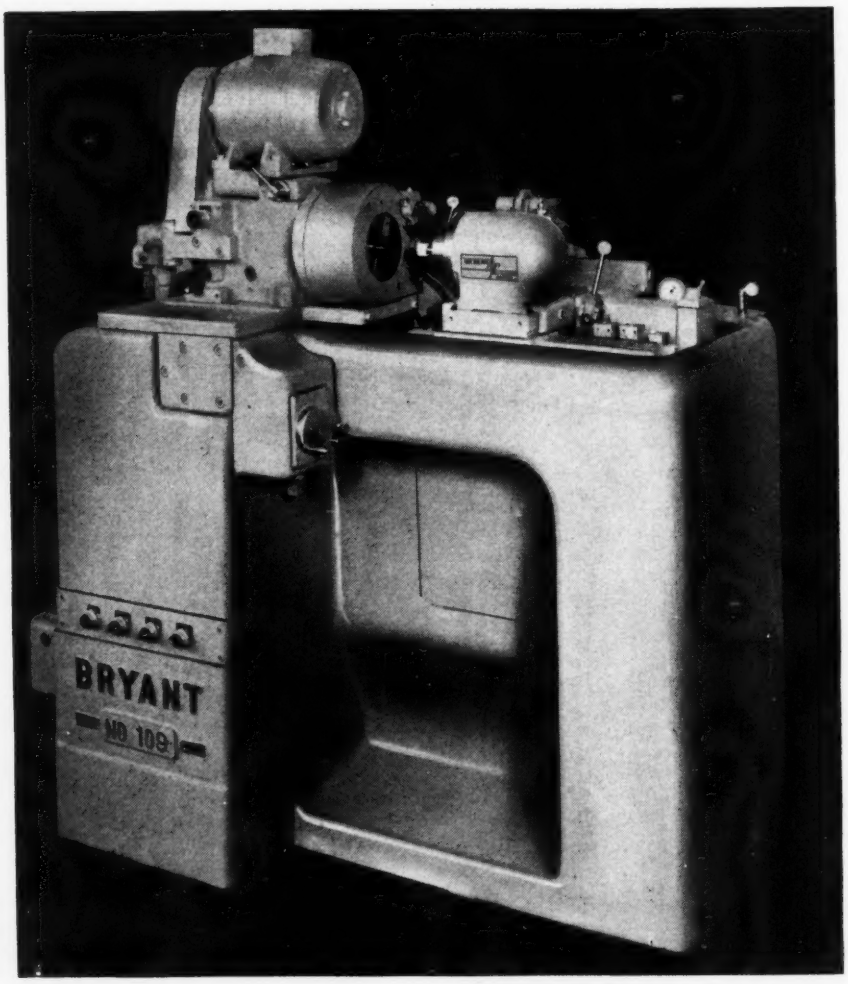


Fig. 1. Bryant Automatic Precision Internal Grinder

To obtain additional information on equipment described on this page, see lower part of page 218.

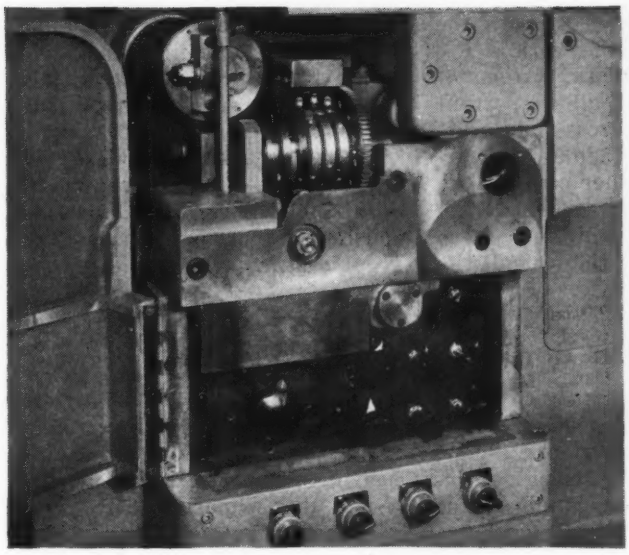


Fig. 2. Automatic Feed Controls of Precision Small-bore Grinding Machine Shown in Fig. 1

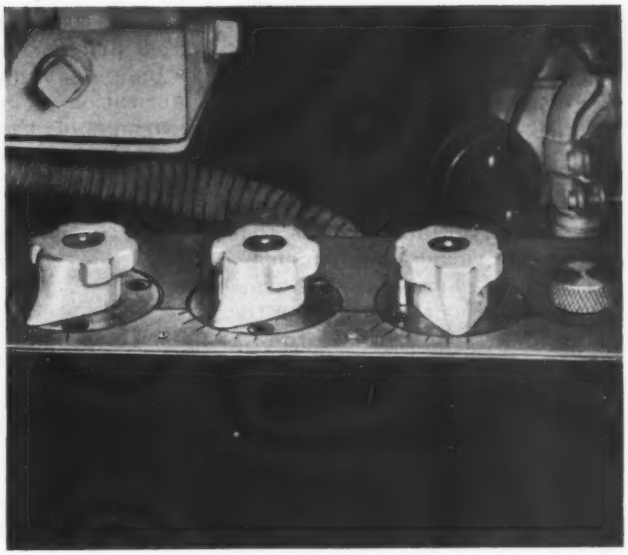


Fig. 3. Hydraulic Controls Provided for the Preselection of Traversing Speeds

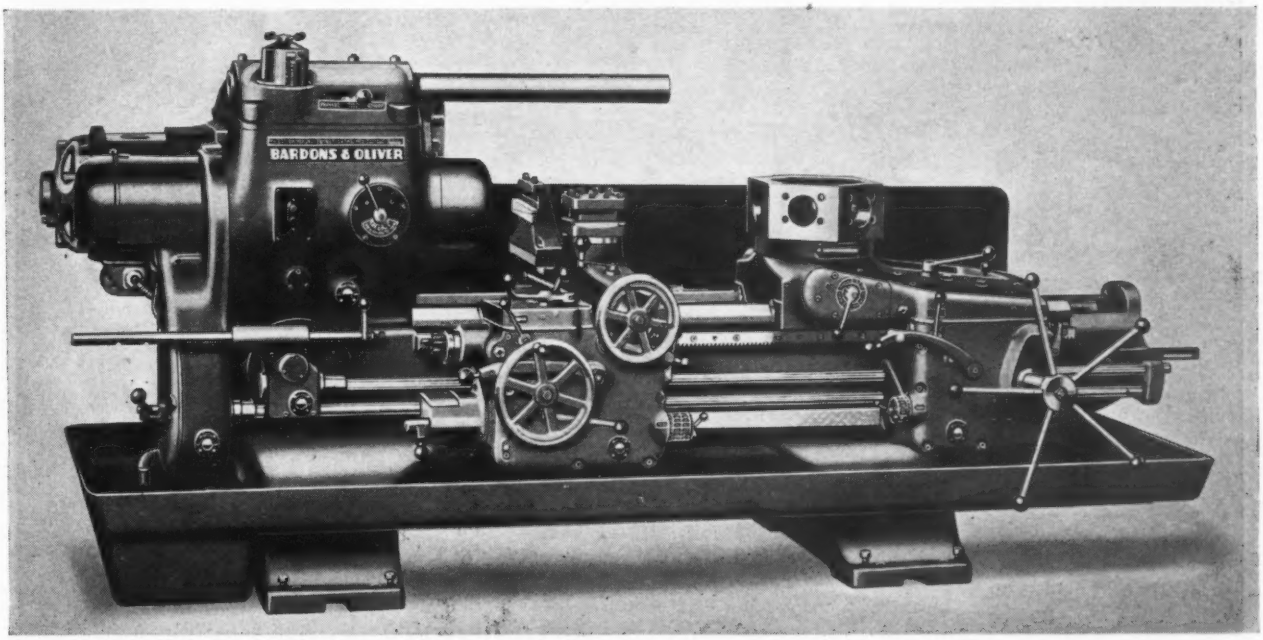
belt-driven wheel-head for operation at speeds from 200 to 2400 R.P.M.

To complete the automatic features of this machine, two methods of work-size control have been made available. The standard machine is equipped with a wheel-truing diamond that automatically compensates for wheel wear to maintain accuracy of the work. The optional method consists of a measuring device for automatically gaging the piece through the work-spindle. This device can be used as a double check when fitted to the machine as extra equipment. 62

Bardons & Oliver Saddle Type Turret Lathe

Bardons & Oliver, Inc., 1133 W. 9th St., Cleveland 13, Ohio, has recently developed a saddle type turret lathe incorporating outstanding features designed to increase production and facilitate operation. This machine is built in capacities for handling bar stock 3 1/2 and 4 1/2 inches in diameter. It has a 15 1/2-inch swing over the cross-slide and a 23 1/2-inch swing over the guides of the bridge type carriage. A 15-inch heavy-duty chuck can be supplied for chucking work. The flange-mounted driving motor delivers sufficient power for heavy cuts at high speeds. The twelve available speed changes are arranged in geometrical progression and are preselective. The hydraulic selector valve on top of the head housing carries a dial that indicates the spindle speed in revolutions per minute and the cutting speed in feet per minute.

A single lever on the head controls starting, stopping, reversing,



Saddle Type Turret Lathe with Hydraulic Equipment Brought out by Bardons & Oliver, Inc.

To obtain additional information on equipment described on this page, see lower part of page 218.

spindle-braking, and gear-shifting. All these functions, including the operation of the multiple-disk forward and reverse clutches, are performed by hydraulic power furnished by a geared pump integral with the head. The manual control lever merely opens or closes the hydraulic circuits that actuate the various mechanisms.

The speed changes can be made instantly without waiting for the gears or the spindle to slow down. Opening of the ring type binder and the indexing and locking of the turret are accomplished by hydraulic power controlled by a hand-lever on the saddle. The power rapid travel for the saddle, longitudinal carriage travel, and the in and out movement of the cross-slide are motor driven.

The nine feed changes in each apron are preselective, being set by feed dial drums. The shifting of the feed-gears by hydraulic power is controlled by the small lever at the end of the dial drum. A sliding gear arrangement provides two feed ranges, giving a total of eighteen changes. The square turret is indexed, locked, and clamped by a remote control lever on the cross-slide. The rear of the slide is designed to receive any one of several toolposts. Cutters can be mounted at both the front and rear of the work.

Individual automatic systems of lubrication serve all important bearings of the cross-slide, carriage, turret, and saddle. All bearings, gears, and other parts in the two aprons are spray lubricated.

A system of high-precision stops for the carriage and the saddle facilitates accurate duplication of parts. The leader and follower type screw-cutting attachment for the carriage can be disengaged automatically for cutting threads to necked shoulders. The carriage taper attachment mounted at the rear can be clamped and unclamped by a single lever at the front of the carriage. 63

Natco Boring and Facing Machine

The National Automatic Tool Co., Inc., Department 40, Richmond, Ind., has developed a new boring and facing machine designed for faster handling of precision boring work on large awkward castings by semi-skilled operators. This new multi-way machine, known as the "Borface," employs either the A-20A units, as shown in Fig. 1, or the A-20B units, as illustrated in Fig. 2.

These units can be mounted horizontally, vertically, or at an angle to suit the job. The only difference in the units shown in Figs. 1 and 2 is that the ones shown in Fig. 2 are provided with an automatic cross-facing drive and control, which is inserted between the rear end of the spindle unit and the spindle drive motor.

The Natco "Borface" units are provided with heavy-duty spindles mounted on preloaded precision bearings, and have worm-gear and V-belt drives designed to insure a smooth flow of power to the cutter bits. The two machines illustrated in Fig. 1 were recently installed in the plant of a motor manufacturer for rough- and finish-boring eight sizes of cast-iron motor yokes with a minimum central bore of 7 to 11 1/2 inches in diameter, and a counterbore 9 1/4 to 14 1/8 inches in diameter.

An alternating-current motor is used for driving the spindles of the machine shown in the foreground, which is employed for rough-boring, counterboring, and chamfering. The machine illustrated in the background has a

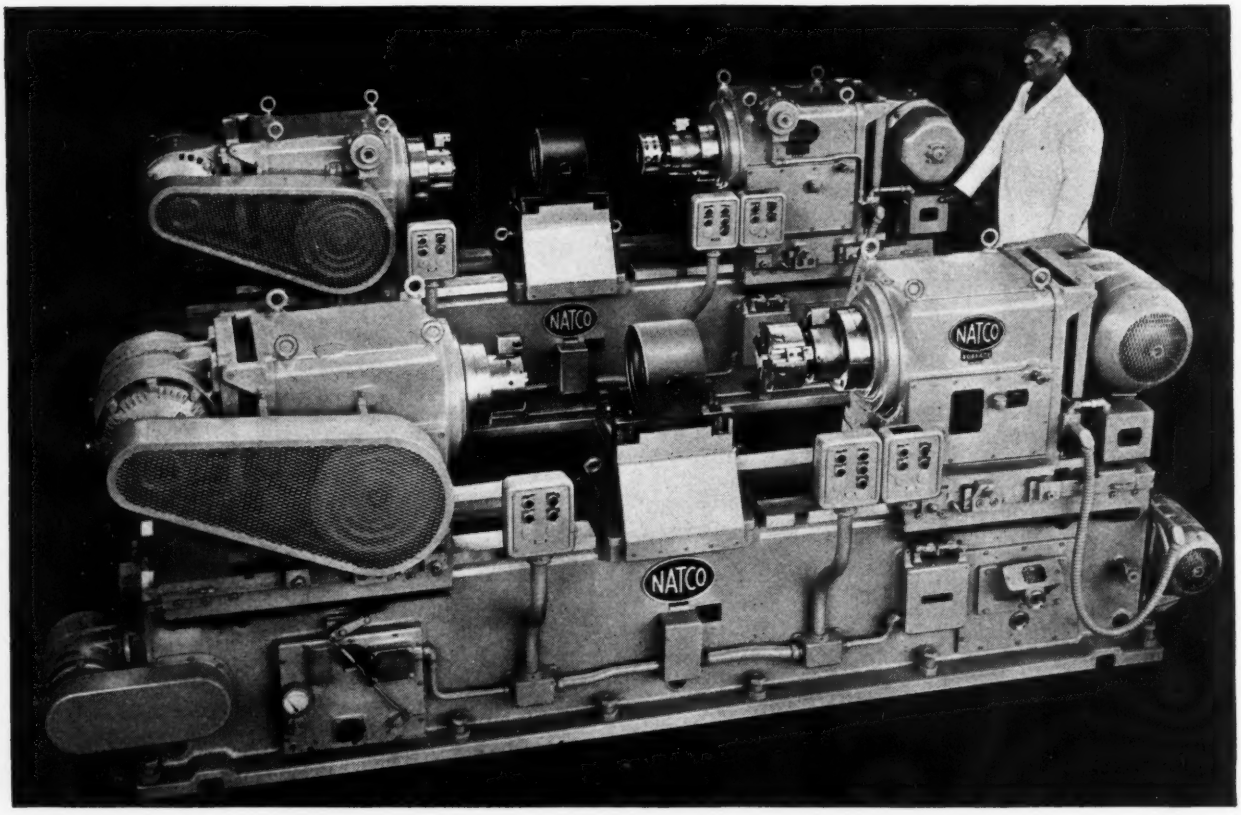


Fig. 1. Natco Boring and Facing Machines Equipped for Boring Motor Frames

To obtain additional information on equipment described on this page, see lower part of page 218.

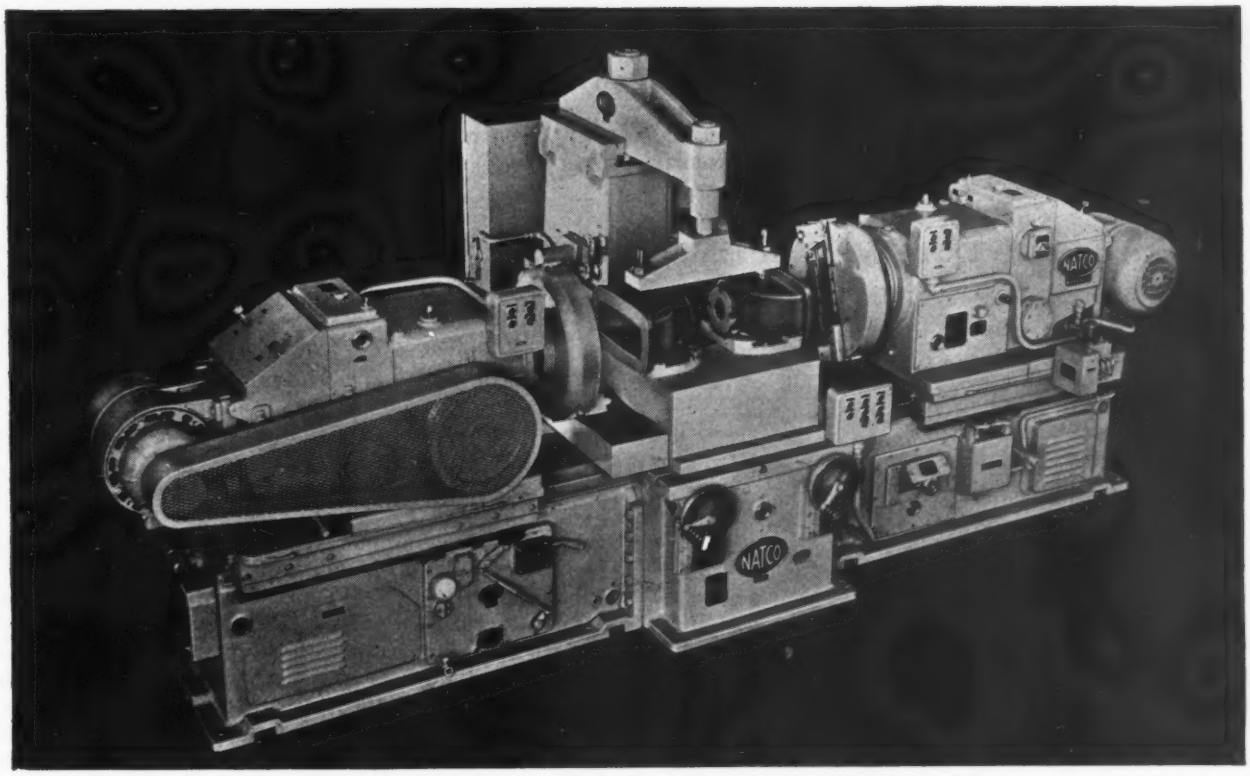


Fig. 2. Natco "Borface" Machine Equipped for Facing Two Valve Bonnets Simultaneously

direct-current variable-speed drive which provides the wide range of spindle speeds required for the final boring and counterboring operations. Production on this job depends on the size of the motor frame machined; from eight to twenty-four parts per hour, with limits on bores and counterbores of plus or minus 0.001 inch for both size and concentricity, is an average production rate.

The machine shown in Fig. 2 is equipped with two "Borface" units located horizontally and facing each other as required for facing both ends of valve bodies simultaneously. However, the machine is shown being used for facing two valve bonnets at the same time at a production rate of one bonnet a minute. 64

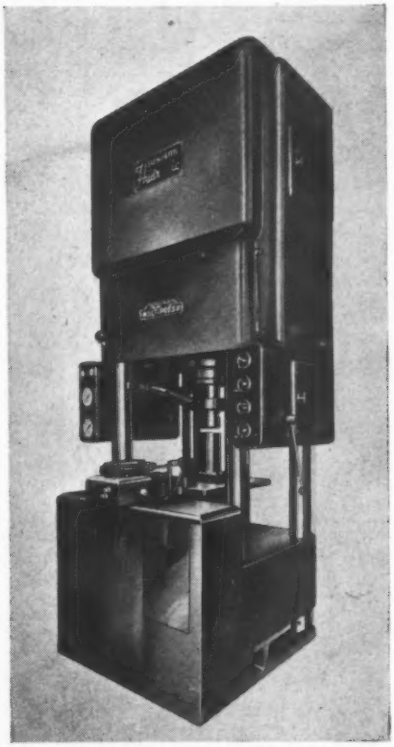
Diamond Polishing Compound

The Sapphire Products Division, Elgin National Watch Co., Aurora, Ill., has placed on the market a new diamond polishing compound said to be more efficient in its use of the diamond and in cutting effectiveness than compounds previously available. This compound has a synthetic vehicle developed to provide permanent dispersion of the diamond particles, so that they are kept separated from one another in uniform suspension. The viscosity, rate of breakdown under the heat of abrasive operations, particle size, and concentration of the diamond particles of this compound are accurately predetermined, so that it can be applied with maximum efficiency. 65

Denison 75-Ton "Multipress" with Vibratory Control

The vibratory control feature incorporated in the bench size "Multipress" recently brought out by the Denison Engineering Co., 1160 Dublin Road, Columbus 16, Ohio, is now available in a new 75-ton "Multipress." This new press was brought out to meet the demand for a larger machine than the bench model which would have the same operating advantages as the small machine. This four-strain-rod press is designed to meet practically every pressing cycle need within its range, and is available with a choice of three valve combinations.

Among its characteristics are automatic or ram cycling; fast traverse and slow pressing speeds; pressure and distance reversal control; low ram tonnage with high return and accessory pressures; large tooling area; one-man operation; 30-inch daylight opening and 18-inch stroke; and pres-



"Multipress" with Vibratory Control Built by Denison Engineering Co.

To obtain additional information on equipment described on this page, see lower part of page 218.

surized filter system with all adjustments and operating control gages located at the operator's finger-tips.

Simple adjustments give this machine a pressure variation of from 7 1/2 to 75 tons, making it readily adaptable to a wide variety of applications. With this equipment, the user can obtain manual or automatic "work fit" control of every essential press cycle. 66

American Three-Way Broaching Machine

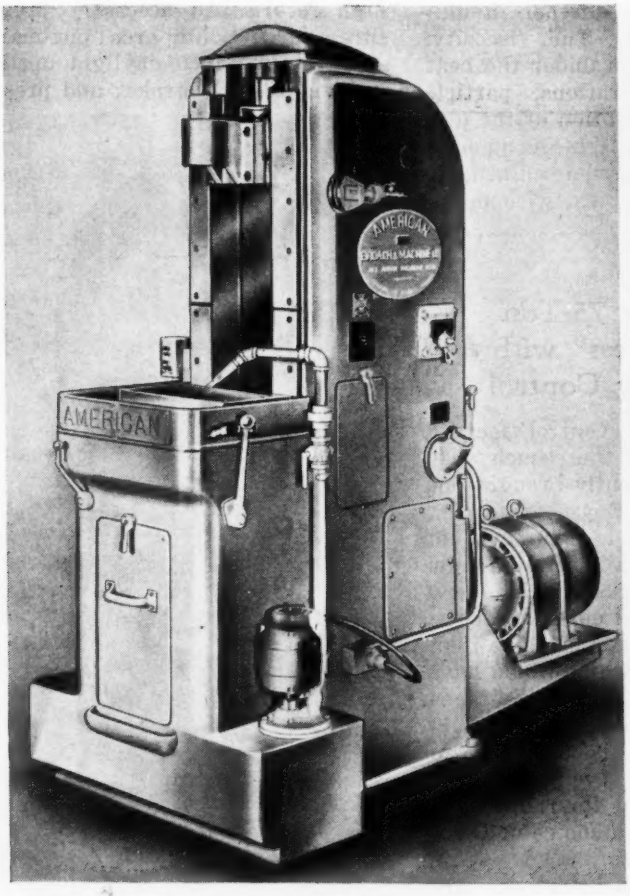
The American Broach & Machine Co., 415 W. Huron St., Ann Arbor, Mich., has announced important changes in the design of the vertical hydraulic Type T three-way broaching machine made by the company. Outstanding improvements have been made in the coolant assembly, while minor changes have been made in the design of the work-table. Coolant is now supplied from an enlarged reservoir in the work-table base by an integral motor and centrifugal pump unit. This equipment is located on the side of the machine below the operating lever, and is mounted in such a manner that the pumping unit can be taken out by removing four screws and disconnecting the inlet and discharge pipes. The inlet pipe is provided with a screen to prevent large chips from passing through the pump. The coolant discharge pipe extends 8 inches above the work-table, and the shut-off valve is located at table height. Control of the coolant pump motor is by a start-stop push-button station.

This machine is manufactured in 4-, 6-, and 8-ton sizes with 24-inch stroke, and 6-, 10-, and 15-ton sizes with a 36-inch stroke. It is adaptable to push, pull, and surface broaching operations, and can be quickly changed over for any one of these types of broaching. It is also adapted for arbor straightening work. 67

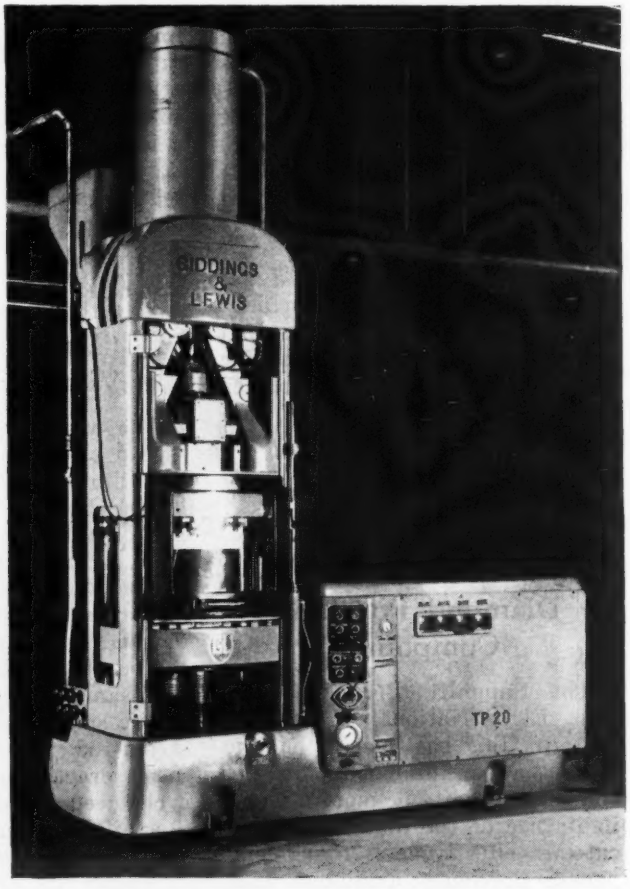
Giddings & Lewis Vertical Plastics Injection Molding Press

Vertical construction incorporating a single hydraulic cylinder characterizes a new plastics injection molding press manufactured by the Giddings & Lewis Machine Tool Co., 140 Doty St., Fond du Lac, Wis. The new vertical arrangement is said to facilitate the provision of means for clamping the mold halves together and injecting the plastic material into the mold cavity in one stroke of the piston-rod. The piston is operated by a self-contained hydraulic unit.

When the hydraulic fluid is admitted to the cylinder, the movement of the piston-rod operates a toggle mechanism which locks the die-plates together. Continued downward movement of the piston-rod causes it to act as a plunger for injecting the thermoplastic material into the mold. Because of the dual function of the piston-rod, the over-all cycle time of this



Three-way Broaching Machine Brought out by the American Broach & Machine Co.

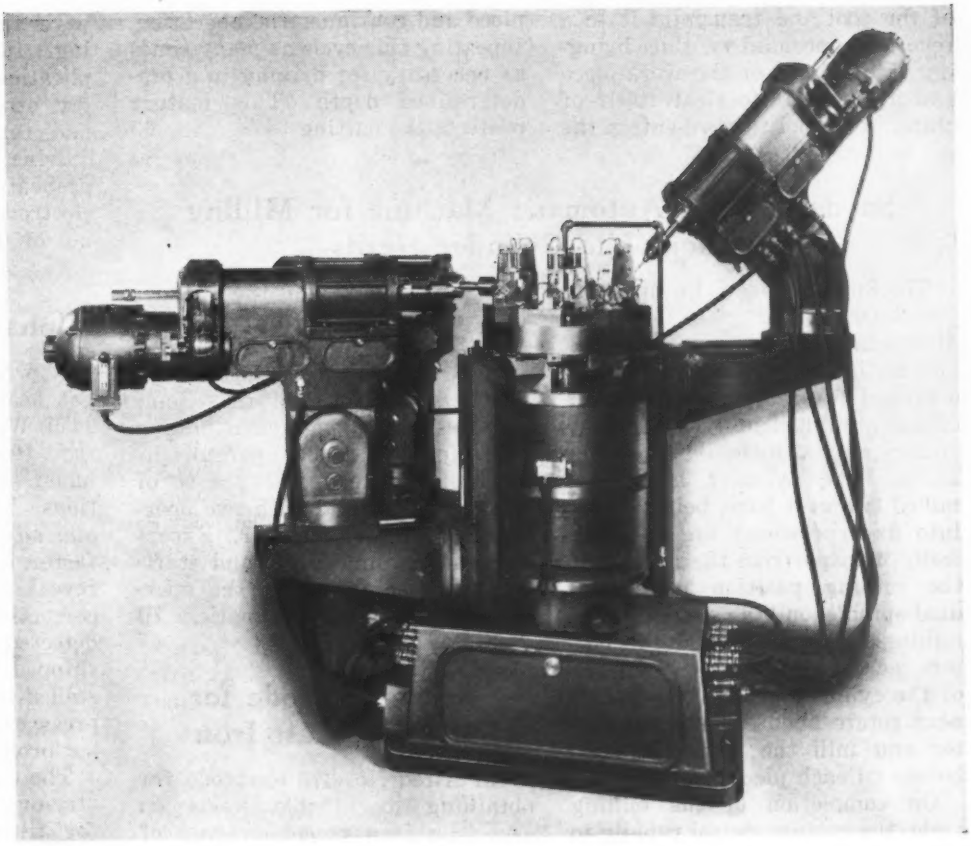


Vertical Plastics Injection Molding Press Built by the Giddings & Lewis Machine Tool Co.

To obtain additional information on equipment described on this page, see lower part of page 218.

new vertical injection press is reduced.

Difficulties experienced with insert molding have been due largely to failure to provide holding mechanisms that would prevent the inserts from falling or slipping out of place. On the horizontal type machines that have the molds mounted vertically, the force of gravity often causes considerable trouble through displacement of the inserts. Vertical construction of the new injection press, however, eliminates the need for elaborate insert holding devices. This is said not only to simplify insert molding operations, but also to prevent possible damage to molds, because the inserts are held in position by gravity and are not subject to slipping or falling.



Universal "Tri-Tec" Drilling Machine Brought out by Churchill, Inc.

The vertical design of the new machine also facilitates quick changing of the heating cylinders. Because of the easier accessibility, the change-over time has been reduced to about twenty minutes. This makes it practical to have a supply of heating cylinders for different plastic materials, and also materials of different colors. Effective savings are thus made by reducing the machine "down time" and eliminating material loss. Additional structural members include simplified equipment for handling molds without requiring overhead cranes.

All units of the press are easily accessible. Control stations are within easy reach of the operator. The controls can be set for manual, semi-automatic, or automatic operation. Interlocked circuits are employed to insure safe operation. The machine can be stopped instantly at any point reached by the piston when the stop-button is depressed. A full-view aluminum and plastic safety gate is provided which is fully automatic. 68

"Tri-Tec" Universal Drilling Machines

Churchill, Inc., Chittenango, N. Y., has developed a line of neumatically or hydraulically controlled "Tri-Tec" universal drilling machines for high-production operation on a wide range of work. The machines in this line can be equipped for handling special production drilling jobs, and can be adjusted to meet any requirements.

The 18-inch "Tri-Tec" drilling machine illustrated is the smallest of the line. It is shown equipped with three heads for handling a special job. The tooling is mounted on a plate, and to change from one job to another, the tooling plate is simply lifted off and replaced by another with the required tooling equipment.

These drilling machines can be furnished in five sizes, each of which has four spindles. The 18-inch size will take six heads; the 24-inch size twelve heads; the 36-inch size twenty-four heads; the 48-inch size thirty heads; and the 60-inch size forty heads.

These machines were designed for group drilling, reaming, and tapping of holes in any desired sequence or pattern. The pieces to be drilled can be placed on a jig or fixture or in a collet or chuck, either separately or in groups, and can be fed automatically to the machine as it is indexed. Positioning for the desired hole locations is obtained through adjustment of the arm supports attached to the body of the machine. These supports, which carry the drill heads, can be moved radially, vertically, or horizontally, and can be placed at any angle from 45 degrees below to 45 degrees above the horizontal. The faceplate holding the jigs or fixtures is carried by a central spindle, which rotates clockwise.

Holes can be drilled, reamed, or tapped from the smallest drill size up to 1/2 inch in diameter. The spindle movement of this machine is controlled and timed by an adjustable cam action, which also controls the indexing mechanism and positioning lock mechanism.

An outstanding feature of this machine is the "tool torque control," which is so designed that it picks up any excess torque pressure applied to the cutting point

described on this page, see lower part of page 218.
To obtain additional information on equipment

of the tool and transmits it to a reversing mechanism, thus bringing the tool out of the work-piece and allowing it to clear itself of chips. The tool then re-enters the piece and continues the operation, repeating this cycle as many times as necessary for drilling to a predetermined depth. This feature protects the cutting tools. 69

Snyder Special Automatic Machine for Milling Automobile Cylinder Heads

The Snyder Tool & Engineering Co., 3400 E. Lafayette, Detroit 7, Mich., has brought out a special automatic indexing table machine designed for faster and more accurate milling of the locating spots on automobile cylinder heads. The cylinder heads are milled two at a time, being loaded into fixtures which are automatically indexed from the loading to the milling position under the dual-spindle milling heads. The milling heads then feed the cutters across two bosses on each of the cylinder heads. The cutters next rotate about a common center and mill the remaining two bosses on each piece.

On completion of the milling cycle, the cutters swivel rapidly to their starting positions, and the machine table is indexed for unloading. Since the two locating bosses on each side of the cylinder head are milled by the same cutter, their heights are exactly the same. Equalizing locators on the fixture assure uniform dome thickness after subsequent milling operations. With one operator the machine delivers 290 pieces of work an hour, and with two operators 390 pieces an hour. Except for loading, unloading, and starting the machine cycle, the operation is completely automatic.....70

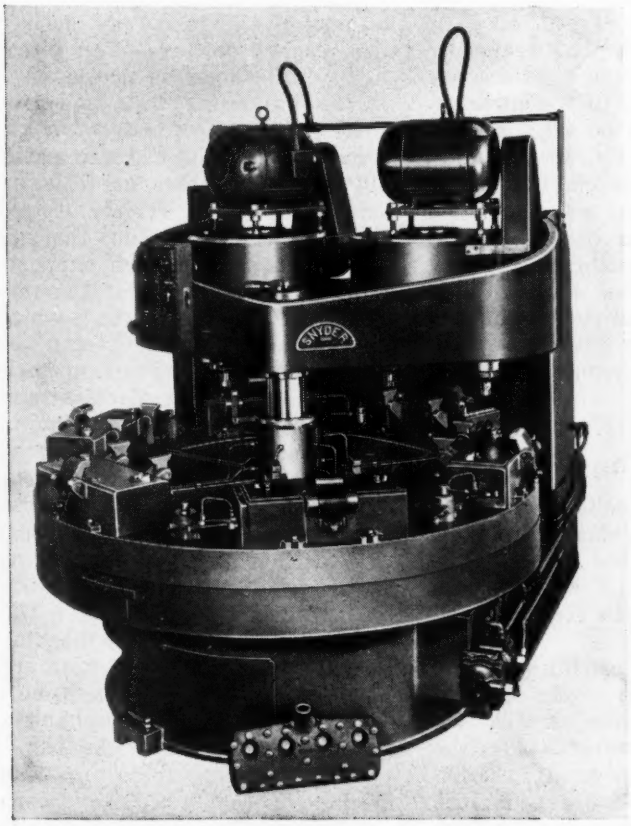
Airco Electrode for Welding Cast Iron

An Airco No. 375 electrode for obtaining machinable welds on cast iron is a recent product of the Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y. This electrode has a high nickel core wire and a heavy extruded coating. It is intended for special applications in the automotive field, for production line repair work, and for use on all castings requiring machinable welds. Usually preheating is not required. The electrode can be used on alternating or direct current. 71

Alpha Die "Try-Out" Press

A press of radically new design has been developed by the Alpha Tool Works, 6432 Beechton, Detroit 10, Mich., for trying out dies under actual production conditions. This press makes finishing and adjusting of the dies easier, faster, and more accurate. It will reveal the necessity for making corrections that too often are not detected until the die has been shipped to the purchaser or installed in the production line. The press can also be used for regular production work.

The outstanding feature of this "try-out" press is the provision for tilting both the upper and lower members of the die into the most convenient positions for performing the necessary finishing



Snyder Indexing Type Automatic Machine Designed for Milling Cylinder Heads

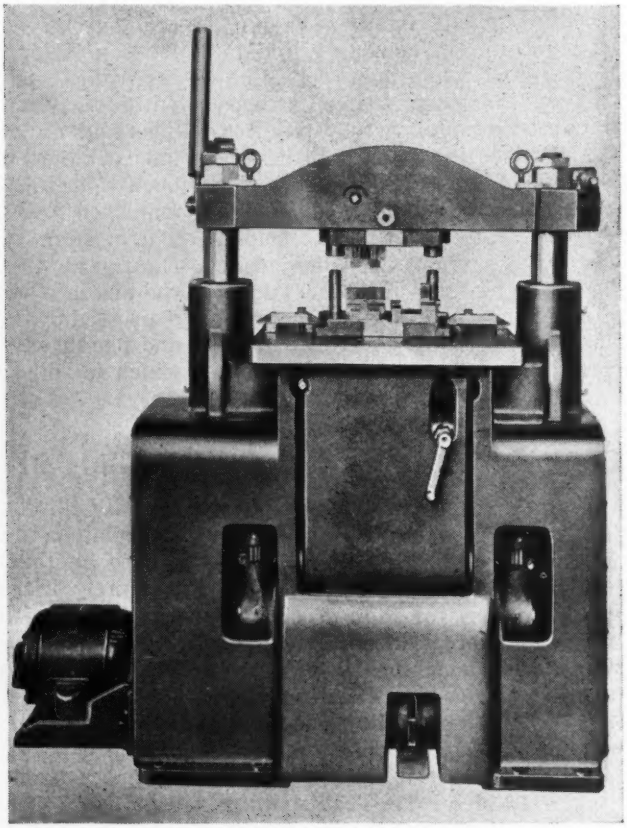


Fig. 1. Forty-ton "Try-out" Press Built by the Alpha Tool Works

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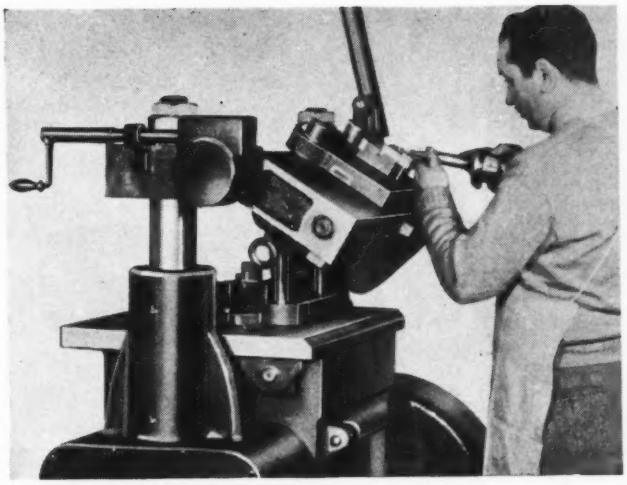


Fig. 2. "Try-out" Press with Punch Member of Die Tilted into Position for Adjustment

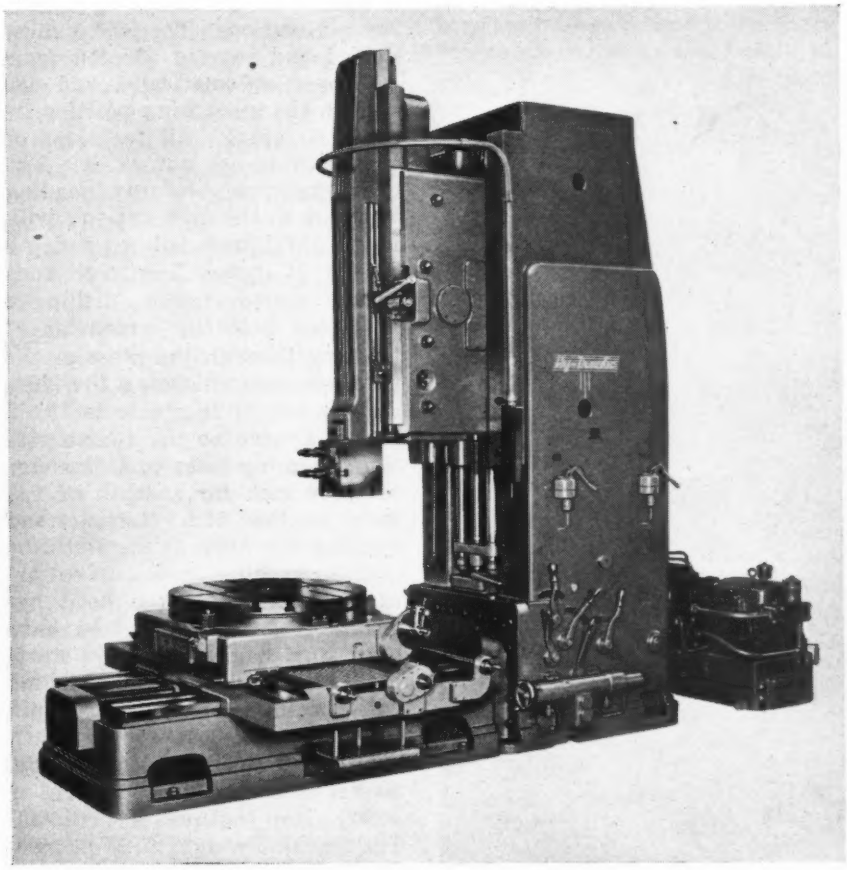
Fig. 3. "Try-out" Press with Die Tilted into Convenient Position for Adjustment

work without removing the die members from the press. Positioning pins which are retracted by means of a crank allow the bolster and head to be tilted so that the die members are easily accessible, as shown in Figs. 2 and 3. When corrections are completed, the die members are returned to their original positions for checking.

The specifications of the press are as follows: Capacity, 40 tons; stroke, 3 3/4 inches; speed, 100 strokes per minute; maximum shut height, 8 inches, and minimum shut height 6 inches; and clearance between columns, 27 inches. 72

Rockford "Hy-Draulic" Slotters

Two large-size "Hy-Draulic" slotters have just been placed on the market by the Rockford Machine Tool Co., Rockford, Ill. One machine is a 48-inch stroke slotter, and the other an improved 36-inch stroke slotter. These machines have massive columns, designed to provide adequate rigidity for the heaviest type of work. The rams can be set for travel in a vertical plane or in any tilted plane up to 15 degrees from the vertical position. The ram cutting and return stroke speeds are infinitely adjustable over a wide range. The hydraulic drive to the ram permits the stroke lengths to be easily set by valve control exactly as required. The smooth cutting and return strokes of the ram are said to result in accurate work and fine finish.



"Hy-Draulic" Slotter Brought out by the Rockford Machine Tool Co.

All electrical and hydraulic controls are centralized on the push-button panel mounted on the column. The table provides three types of work feed—rotary, transverse, and longitudinal. Provision is made for easy manual operation of the table when setting up the machine.

These machines have a cutting speed range of 0 to 80 feet per minute; a table diameter of 42 inches; transverse table travel of 36 inches; and longitudinal table travel of 42 inches. Both the transverse and longitudinal table feed ranges are from 0 to 0.140 inch. The rotary table feed range

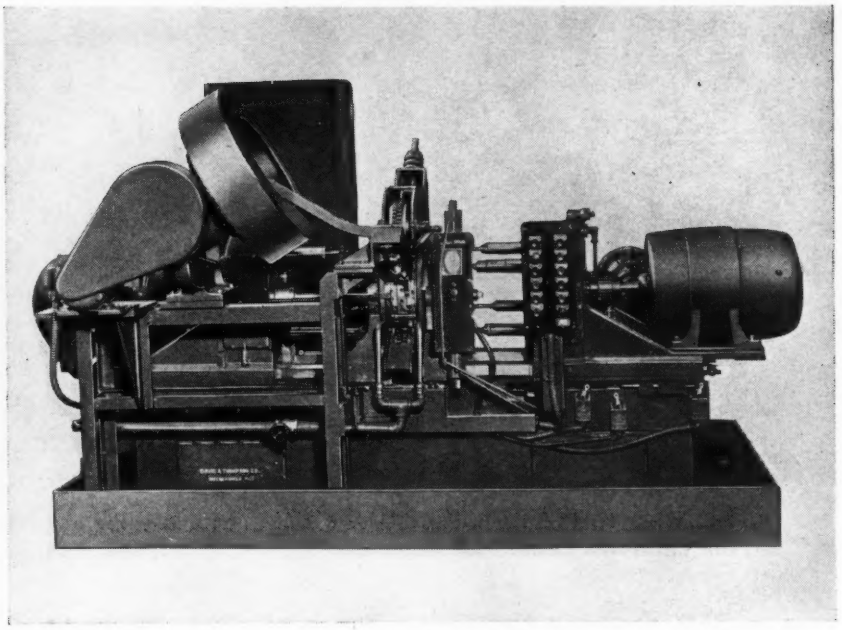
To obtain additional information on equipment described on this page, see lower part of page 218.

is from 0 to 0.140 inch on a 16-inch circle. The maximum distance from the table to the lower face of the tool-head, as set by ram adjustment, is 54 inches for the smaller machine and 60 inches for the larger machine. 73

Besly Double-Spindle Wet Grinder

Charles H. Besly & Co., 118-124 N. Clinton St., Chicago 6, Ill., have recently introduced a new type 30-inch double-spindle wet grinder designed for grinding double-end drop-forged engineer's wrenches and many other parts that require the grinding of parallel surfaces. This grinder has a combination magnetic vibrator and automatic chain feed, arranged especially for speedy and accurate feeding of the wrenches through the grinder. Using oil as a coolant, this machine is capable of grinding all four surfaces of a wrench having an over-all length of 8 inches at the rate of 2400 per hour.

The grinder is so designed that the wrenches are guided straight through the machine between the grinding wheels. In this way their sides are ground parallel and the ends held to the required thickness within close limits. 74



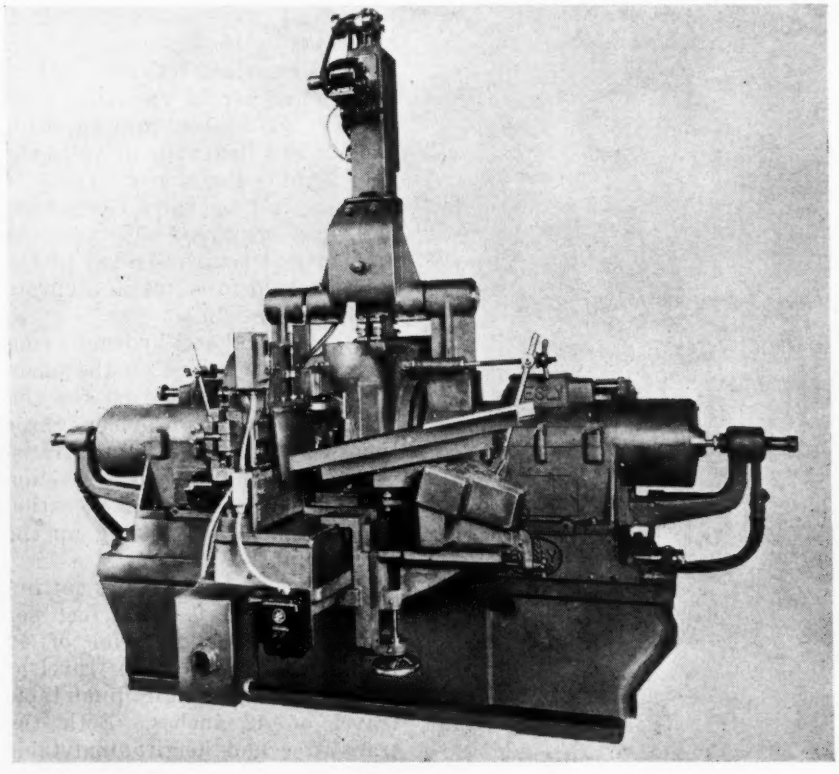
Automatic Machine Equipped for Drilling and Reaming Wrist-pins

Davis & Thompson Drilling and Reaming Machine

The Davis & Thompson Co., 6411 W. Burnham St., Milwaukee 14, Wis., has developed an automatic horizontal machine for drilling and reaming wrist-pins. It can also be used for operations on parts that vary somewhat in size and shape. The two opposed drilling heads of the machine are mounted on a common bed, and are driven by two 7 1/2-H.P. motors. Horizontal movement of the heads on the ways is accomplished through a single hydraulic cylinder and a rack and pinion drive.

The hydraulic indexing fixture has six stations. The pieces to be drilled and reamed are fed from a hopper automatically, and are held in the machining position by chain clamping. All functions of the machine are automatic. The operating cycle consists of loading the work at the first station; drilling a 15/32-inch hole to a depth of 1 3/64 inches from both ends at the second station; drilling a 7/16-inch hole the remainder of the way through the piece at the third station; enlarging the holes at each end of the piece to 19/32 inch diameter at the fourth station; reaming holes to a diameter of 0.600 inch for a depth of 1/2 inch at the fifth station; and ejecting the work at the sixth.

The machine cycle is so arranged that after the head hydraulic and coolant motors have been started and the cycle starting button pressed, the machine will continue its cycle of rapid advance, feed, and rapid return movements until the cycle stop, master stop, emergency return, or safety stop button is actuated. The machine weighs 6198 pounds, and has a production rate of 300 pieces an hour. 75



Besly Double-spindle Parallel-surface Wet Grinding Machine

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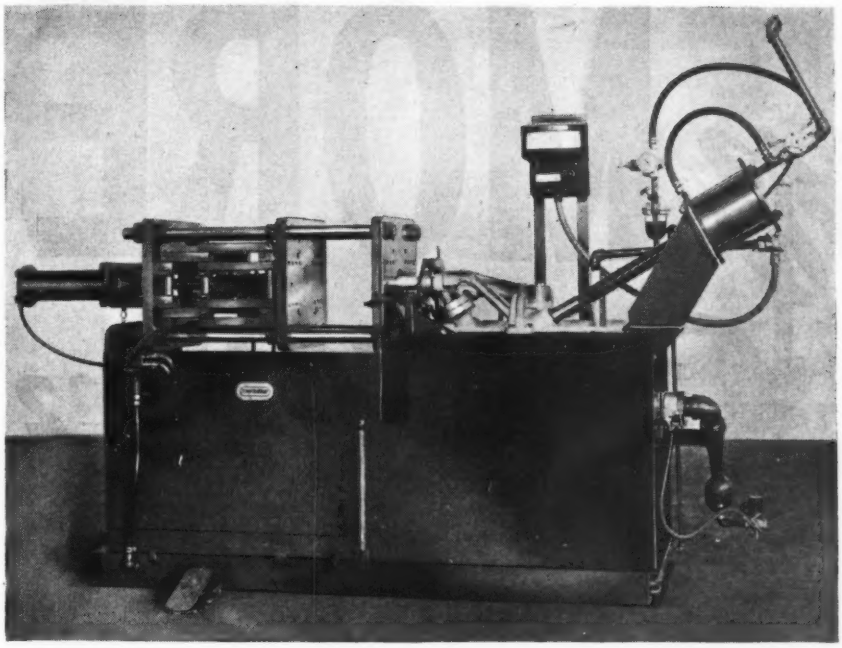


Packaged Die-casting Machine Distributed by the Ermac Co.

Packaged Die-Casting Machine

A new self-contained "hot shot" die-casting machine manufactured by the Robert A. Cox Co. is being distributed by the Ermac Co., 1426 S. Santa Fe Ave., Los Angeles 21, Calif. This air-operated medium-size machine is said to be adapted to the needs of manufacturers having intermittent die-casting work, who do not maintain a regular die-casting department. It can be easily installed, and no special training is required for its operation.

This die-casting machine has single hook-ups for air, gas, and 110-volt electrical current. It is furnished with the necessary blow-torches for heating the goose-neck and nozzle. Standard equipment includes a Willco pyrometer, thermo-couple, holding furnace, and venturi type gas burner. The pot for holding the molten metal has a capacity for 300 pounds of zinc alloy.

The die-plates are 16 by 16 inches, and the space between bars is 11 by 11 inches. The available die space is 11 by 16 inches, the die stroke 7 inches, and the maximum die space 13 inches. The diameter of the die cylinder is 3 1/2 inches, and the maximum casting capacity 1 1/2 pounds. The maximum operating capacity is 720 "shots" per hour. The machine weighs approximately 1500 pounds. It occupies a floor space of 22 by 72 inches, and is 40 inches high.

The machine has automatic control of the metal temperature; metal injection control operated by foot-valve; and manually controlled die opening and closing.—76

Bristol Multiple-Spindle Double-Head Machine and Hydraulic Cylinder

A new heavy-duty multiple-spindle double-head boring machine has been developed by the Bristol Machine Tool Co., 913 Wood St., Bristol, Pa. This machine, shown in Fig. 1, will take up to three adjustable spindles on each of the two heads. It was originally built for machining connecting-rods for refrigeration compressors at an output rate of one complete connecting-rod every forty-eight seconds. The operations consist of rough-boring a 2.490-inch diameter and drilling a 0.4218-inch hole; finish-reaming a 2.500-inch bore within limits of plus 0.0005 and minus 0.000 inch on the diameter; and reaming a 0.4375-inch wrist-pin hole and drilling a No. 21 hole for the wrist-pin clamp. The dimension between the main bearing hole and the wrist-pin hole is required to be held to 4.125 inches, plus or minus 0.001 inch.

Another new product of this company, shown in Fig. 2, is a 1500 pounds per square inch oil

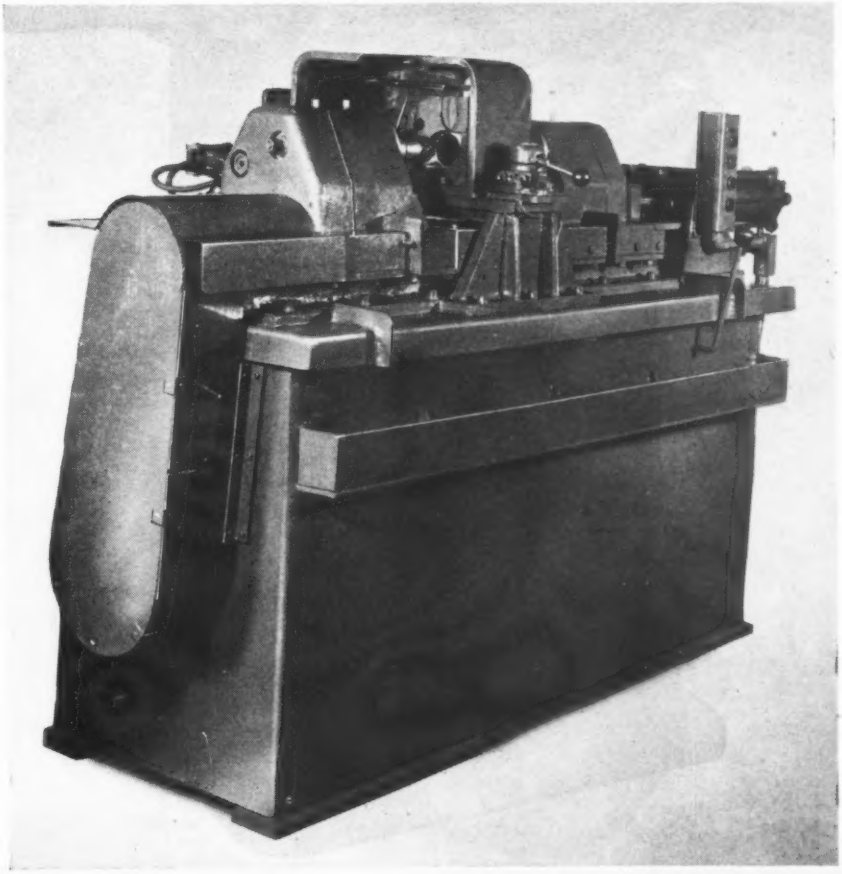
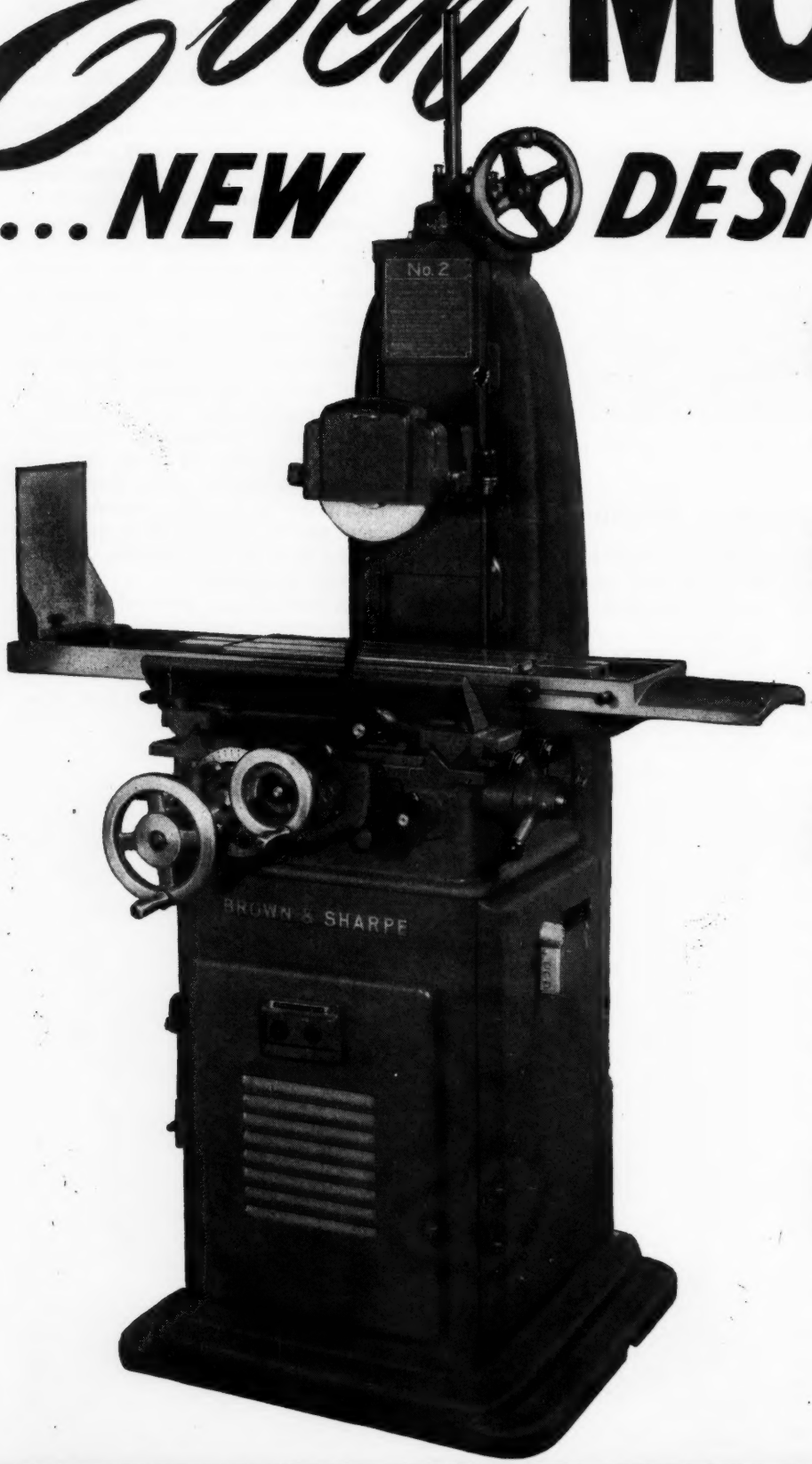


Fig. 1. Bristol Multiple-spindle Heavy-duty Boring Machine

To obtain additional information on equipment described on this page, see lower part of page 218.

Even MORE ...NEW DESIGN No. 2



CONVENIENT CONTROLS

. . . assist in fast and accurate manipulation.

TWO RATES OF TABLE FEED

. . . 19 ft. or 31 ft. per minute. A convenient lever permits operator to readily select rate to suit the nature of the work.

PRECISION WHEEL SPINDLE

. . . choice of interchangeable cartridge type units—close-fitting plain bearing unit or permanently sealed, grease lubricated anti-friction bearing unit. Provides exceptional grinding finish with quick spark-out.

ENCLOSED ELECTRICAL CONTROLS

. . . housed in a separate compartment.

BROWN &

VERSATILITY

SURFACE GRINDING MACHINE

IMPROVED COLUMN CONSTRUCTION

. . . for increased rigidity.

EFFICIENT DRIVE

. . . either by motor in base or motorized spindle.

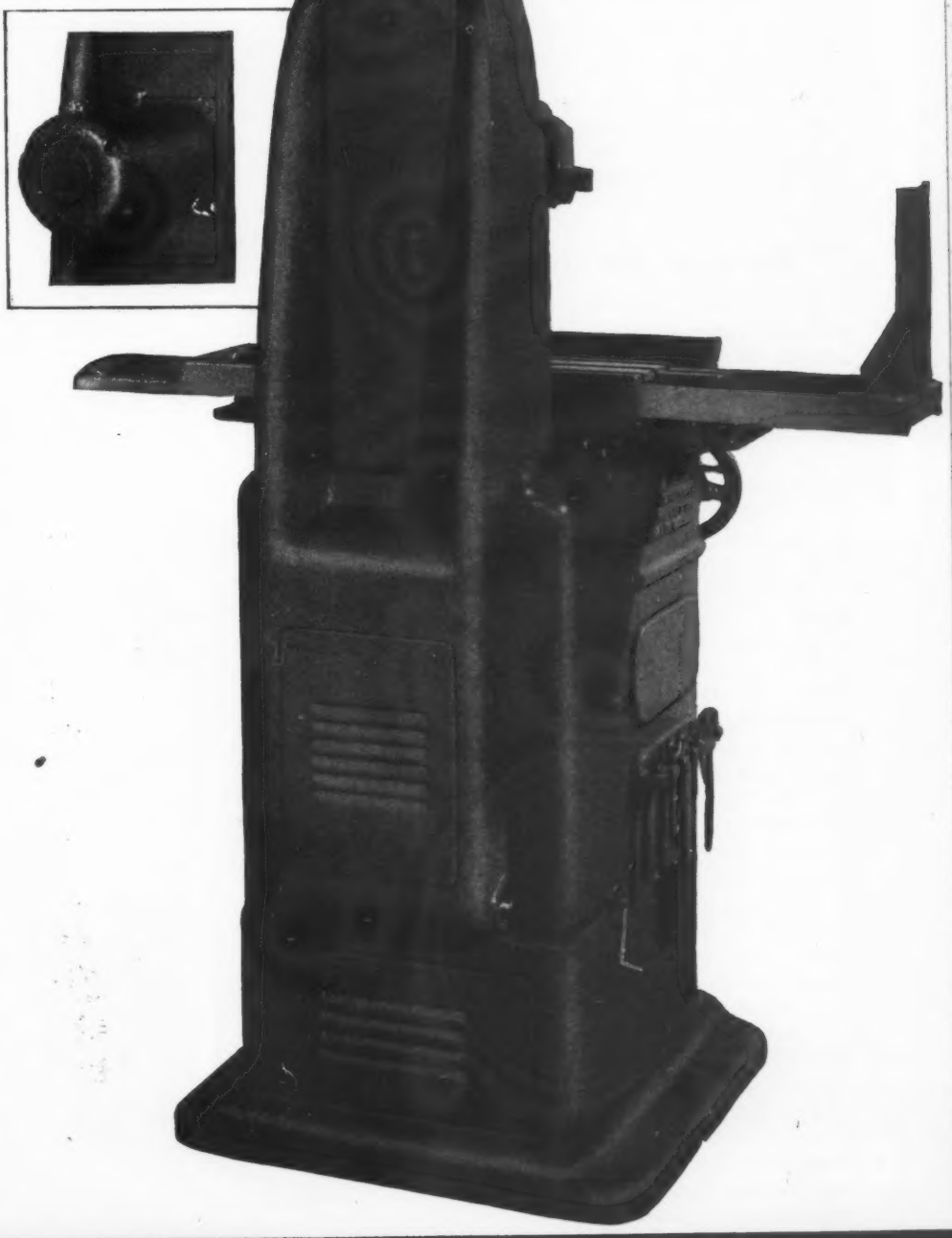
Motor in base drives spindle and table through one endless belt, concealed yet readily accessible.

Motorized spindle (shown in insert) is driven through a vibration-dampening coupling by an in-line motor. A ¼ h.p. motor in the base is used for table power feed.

IMPROVED GUARDING

. . . for cleanliness and safety.

Ask for specifications—including numerous attachments for broadening the range of usefulness—of the No. 2 and the No. 2B (With Hand Feeds Only) Surface Grinding Machines. Brown & Sharpe Mfg. Co., Providence 1, R.I., U.S.A.



& SHARPE B·S

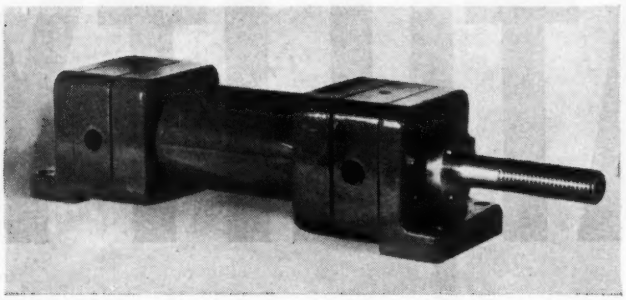
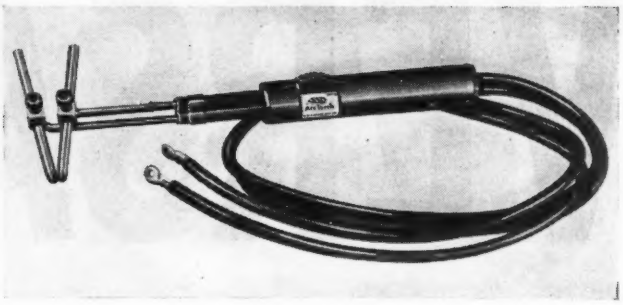


Fig. 2. Bristol Hydraulic Cylinder for Use on Machine Tools



"Knock-Out" Light-weight Arc Torch Made by K. O. Lee Co.

hydraulic cylinder developed for machine tool applications. By the use of simple attachments, nine standard mountings of this hydraulic cylinder can be readily obtained. A built-in self-adjusting cushion at each end of the cylinder is a standard design feature. Automotive piston-rings combined with "O" rings are said to prevent leakage between the cylinder chambers in all cases. ----77

Light-Weight "Knock-Out" Arc Torch

A new light-weight arc torch has been added to the line of "Knock-Out" arc-welding equipment made by the K. O. Lee Co., Aberdeen, S. D. This torch has several new features, including "feather touch" slide control, which provides fast make-and-break of the arc flame with a mere touch of the thumb. When the slide is in the "off" position the torch is shock-proof, will not flash when laid down, and is safe for adjustment or replacement of carbons.

The torch weighs only 1 1/4 pounds, and uses 3/8-inch and 1/4-inch carbons. ----79

Hardalloy Electrode

A new direct-current, reverse-polarity arc-welding electrode known as "Hardalloy" that provides weld metal which is highly resistant to impact or abrasive wear in hard-surfacing applications has been brought out by the McKay Co., 1005 Liberty Ave., Pittsburgh 22, Pa. The weld metal as deposited has a hardness of 59 Rockwell C. It is capable of being heat-treated for machining or grinding and of subsequent reheat-treating to restore it to its "as-deposited" hardness.

The low-hydrogen electrode coating serves to minimize under-bead cracking on hardenable steels. The weld metal fuses readily with the base metal, providing a sound, porosity-free alloy for hard-surface applications. It is available in five sizes, from 3/32 to 1/4 inch in diameter. The current requirement for these sizes ranges from 65 to 75 amperes up to 230 to 260. ----78

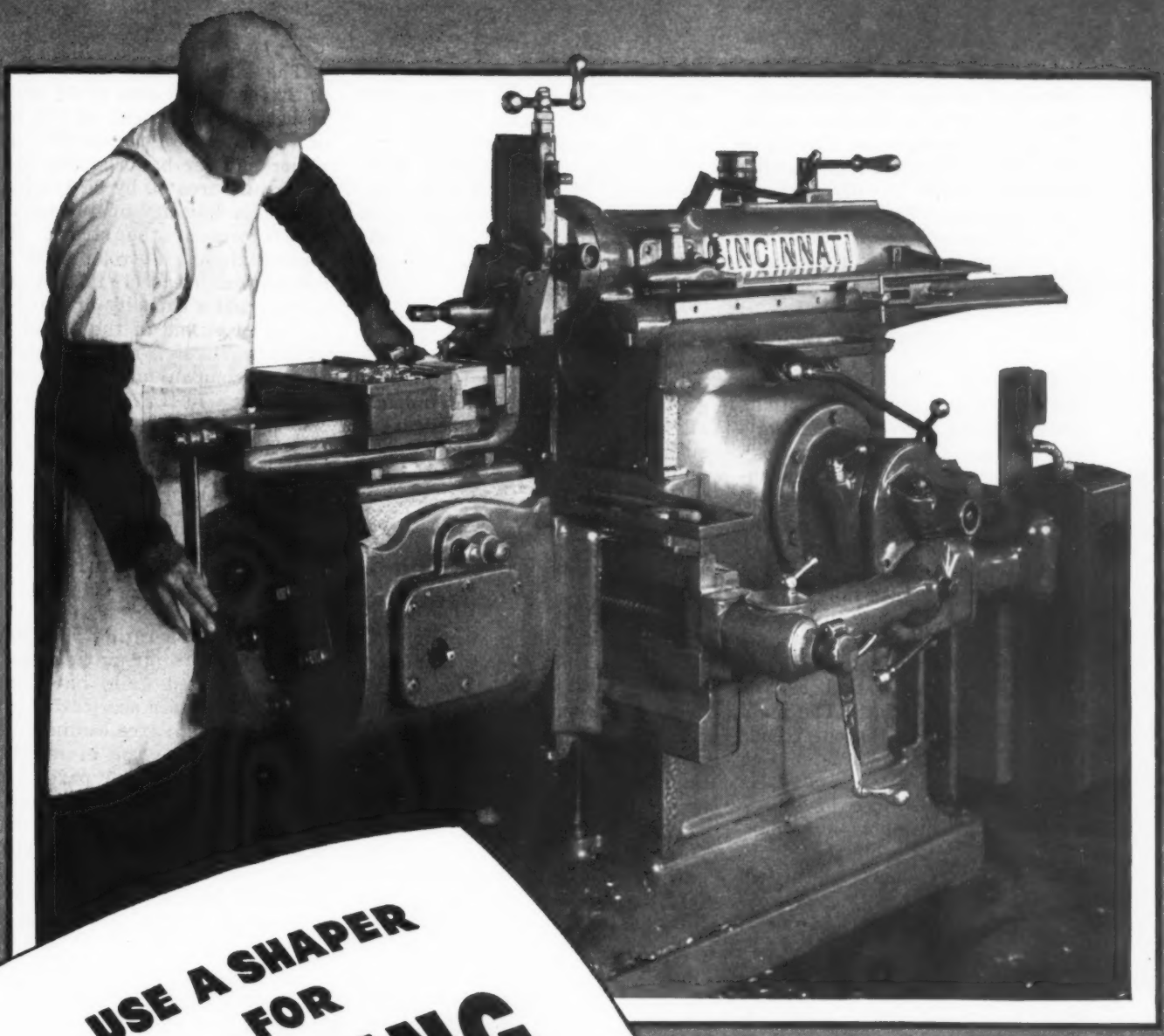
Garvin "Hi-Power" Automatic Tapper

The Garvin "Hi-Power" automatic tapper recently placed on the market by the Western Machine Tool Works, Holland, Mich., is designed to meet the demands for a heavy-duty powerful machine capable of driving the larger sizes of taps. The simple automatic operation feature of the smaller size Garvin tappers has been retained in the new tapper. A simple downward pull on the operating lever causes the tap to enter the predrilled hole, tap to the depth required, reverse, and back out to the original setting, ready for the next cycle. Instantaneous spindle reversal assures accurate tapping to the required depth and prevents tap breakage. Accurate tapping depth is provided by means of a precise tripping device, actuated by stop-nuts on the spindle, which can be locked in any selected position.

The spindle slides on integral involute splines, and is threaded on the lower end to receive a heavy-duty self-centering chuck of either the adjustable type for taps having

Garvin "Hi-Power" Automatic Tapper

To obtain additional information on equipment described on this page, see lower part of page 218.



USE A SHAPER FOR JOBBING

CINCINNATI Shapers have great power, lasting, built-in accuracy and exceptional versatility for jobbing work.

They will do the job the economical way, practically without jigs, or fixtures or special tooling. Quick setup from job to job cuts time and costs.

They are handy, busy, profitable tools in the jobbing shop.

Write for Shaper catalog N-3.

THE CINCINNATI SHAPER CO.

CINCINNATI 25, OHIO U.S.A.

SHAPERS · SHEARS · BRAKES

shanks up to 1 1/4 inches in diameter or of the non-adjustable collet type. The friction clutches within the driving pulleys are adjustable for wear and torque-transmitting capacity, which greatly reduces tap breakage. The members of the clutches subject to wear are so made that they are replaceable after long service. Standard spindle speeds are 64, 86, 124, and 167 R.P.M., but special speeds are available to suit particular requirements. Motors of 5 H.P., operating at 1800 R.P.M., are supplied on order, together with the necessary starter and push-button controls. 80

Bliss Triple-Action Drawing Press

The E. W. Bliss Co., 450 Amsterdam Ave., Detroit 2, Mich., has developed a new line of toggle presses, in which a unique arrangement of the driving mechanism is employed for triple-action drawing of large automobile stampings.

The triple-geared driving mechanism consists essentially of the motor, drive-shaft, and intermediate gearing. The lower plunger is driven by two main crankshafts supported by individual crowns beneath the press bed. The main gears, mounted on the outer ends of the crankshafts, have hubs on each side which serve as the eccentrics for driving the upper plunger and blank-holder mechanisms. Each corner of the blank-holder can be power adjusted, either independently or synchronized with the other three corners. This system of toggle linkage gives the blank-holder an unusually long dwell. It also permits a sufficient dwell for the upper plunger to allow redrawing with the lower slide.

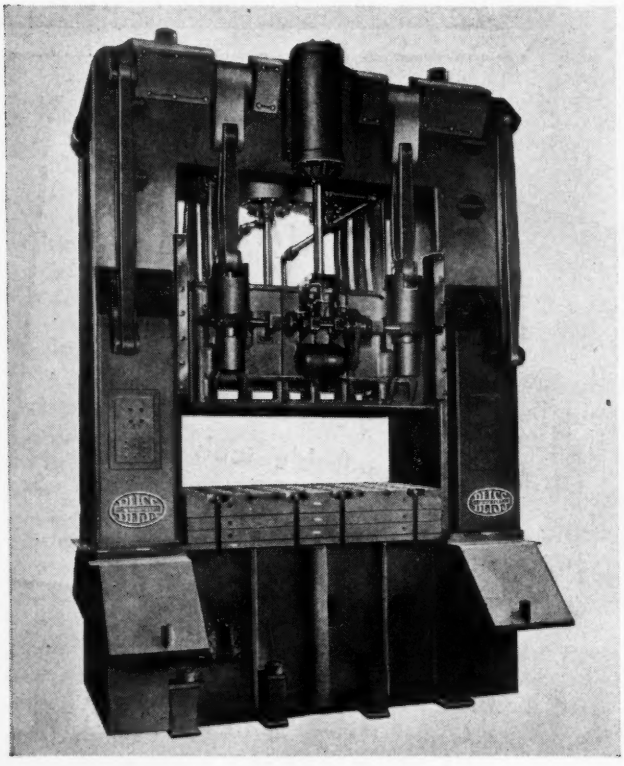
The blank-holder has a stroke of 22 inches, an area of 64 by 106 inches, and a capacity of 275 tons at the bottom of the stroke. The upper plunger has a stroke of 34 inches, an area 50 by 95 1/2 inches, and a capacity of 400 tons at the bottom of the stroke. The lower slide has a stroke of 22 1/4 inches, an area 44 1/2 by 101 inches, and a capacity of 350 tons at the lower end of the stroke.

The particular machine shown in the accompanying illustration is driven by a 75-H.P. motor directly connected through gearing. The total height of this machine is 367 inches, of which 210 inches is above the floor line. 81

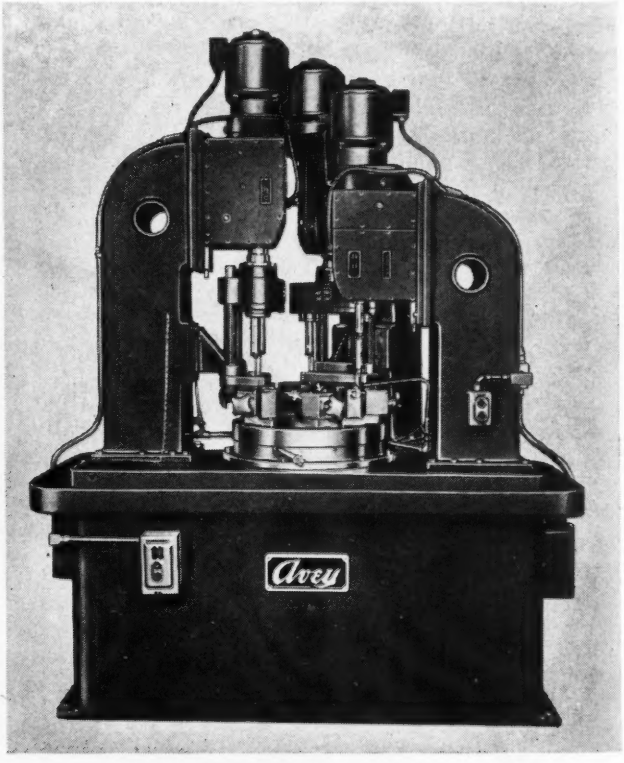
Avey Three-Unit Drilling, Reaming, and Counterboring Machine

The Avey Drilling Machine Co., Cincinnati, Ohio, is now manufacturing adaptations of its No. 1 and No. 2 cam-feed units for use on machines such as the one shown in the illustration, recently built by this company. This machine is designed especially for multiple operation on individual holes, including drilling, counterboring, reaming or redrilling, and tapping at one clamping of the work. The units have electrical controls for operating and synchronizing multiple-unit set-ups.

The cam-feed units have been designed to obtain accelerated production through free loading time and through the use of multiple operations on several parts simultaneously in the time normally required for one operation. The capacities of the cam-feed units are as follows: No. 1, 1/2 inch in cast iron; and No. 2, 7/8 inch in cast iron. 82



Bliss Triple-action Drawing Press



Three-unit Drilling, Reaming, and Counterboring Machine

To obtain additional information on equipment described on this page, see lower part of page 218.

EASY
on both hand and eye

As you reduce operator exertion you increase machine output.

Controls concentrated on the heads of Cincinnati Bickford Super Service Radial Drills are exceedingly "handy" and are easy to manipulate.

The design of the head gives the operator a clear, unobstructed view of the work while standing in a comfortable, normal position—no stopping or twisting for a better view.

These powerful, accurate machines are easy on the hand and eye.

Write for detailed Bulletin R-24A.

RADIAL AND UPRIGHT SUPER SERVICE DRILLING MACHINES

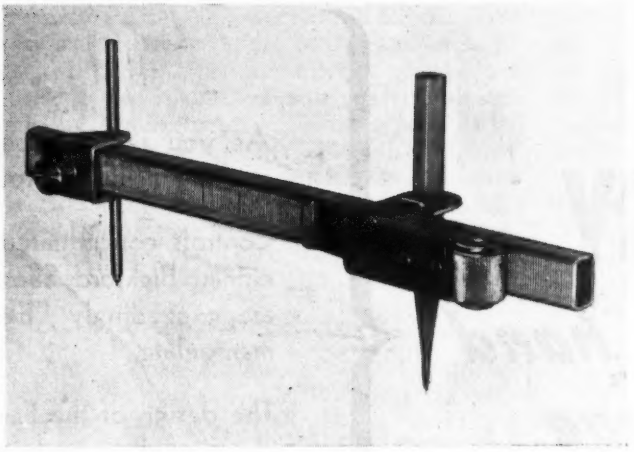
Equal Efficiency of Every Unit Makes the Balanced Machine

See our Condensed Catalog in Sweet's File.

THE CINCINNATI BICKFORD TOOL CO. **Cincinnati 9, Ohio U.S.A.**

Metal Beam Compass

An all-metal beam compass, known as the Bartusch, with unique rack and gear control has been brought out in drafting-room and tool-room types by the Niagara Instrument Corporation, 58 Market St., Lockport, N. Y. The rack and gear control of this beam compass provides for instant precise adjustment by simply pushing the geared roller with the thumb to obtain any radius setting desired. There are no screws to be tightened, and the instrument positively retains its setting.



Bartusch Beam Compass for Drafting-room Use

The self-locking pencil clamp takes pencils of various sizes and inking pens. The beam is made of hard aluminum alloy, anodized for durability. It is of tubular construction, and combines rigidity with light weight. The roller parts are nickel-silver. The beams are made in 12-, 24-, and 36-inch lengths, radius settings up to 68 inches being possible by using connectors to join two of the 36-inch beams.

The metal-scribing compass has a tightening thumb-screw for the scriber head. This instrument is furnished with a hardened steel scriber, but the self-locking clamp also permits the use of a knife, glass-cutter, pencil, or pen. 83

Sheffield "Airlectric Multichek" for Inspecting Pistons

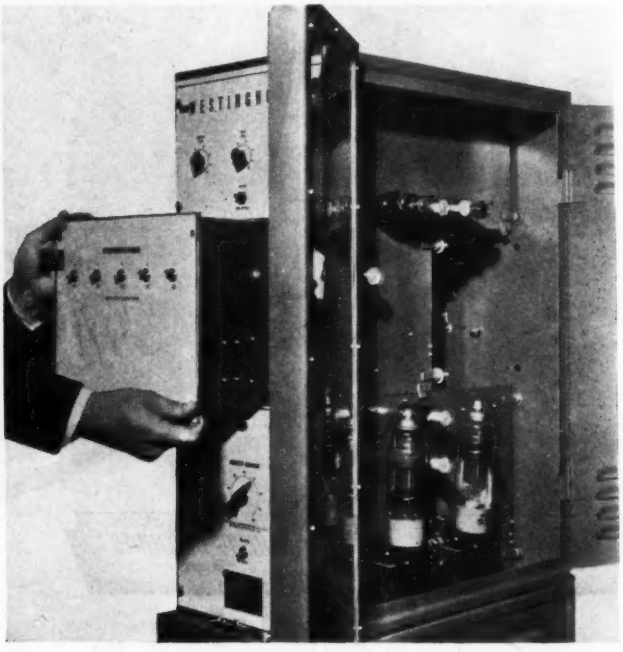
The inspection of numerous critical dimensions of automotive pistons and the segregation of the pistons into eight groups are accomplished in one rapid operation on the "Airlectric Multichek" developed by the Sheffield Corporation, Dayton, Ohio. The pistons to be checked are merely loaded into and removed from this device, the accuracy of the checking operation being entirely independent of the human element. Segregation is made possible by color stamping during the gaging cycle. The rate of inspection and selection is between 500 and 700 pistons per hour.

Each dimension has its own set of red and green signal lights to show if it is under size or over size. All individual dimension circuits are integrated into one master light circuit. A separate set of signal lights on the right of the light panel facilitates setting the "Multichek" with the masters. A bell rings when all dimensions are within tolerance limits. 84

Westinghouse Resistance Welding Controls

A complete line of non-synchronous packaged alternating-current resistance welding controls known as "Weld-O-Timers" has been announced by the Westinghouse Electric Corporation, Pittsburgh 30, Pa. With these new controls, it is possible to obtain hundreds of combinations of sequence controlling and timing

Sheffield "Airlectric Multichek" Developed for the Inspection and Selection of Automotive Pistons



Non-synchronous Packaged Resistance Welding Control Brought out by Westinghouse Electric Corporation

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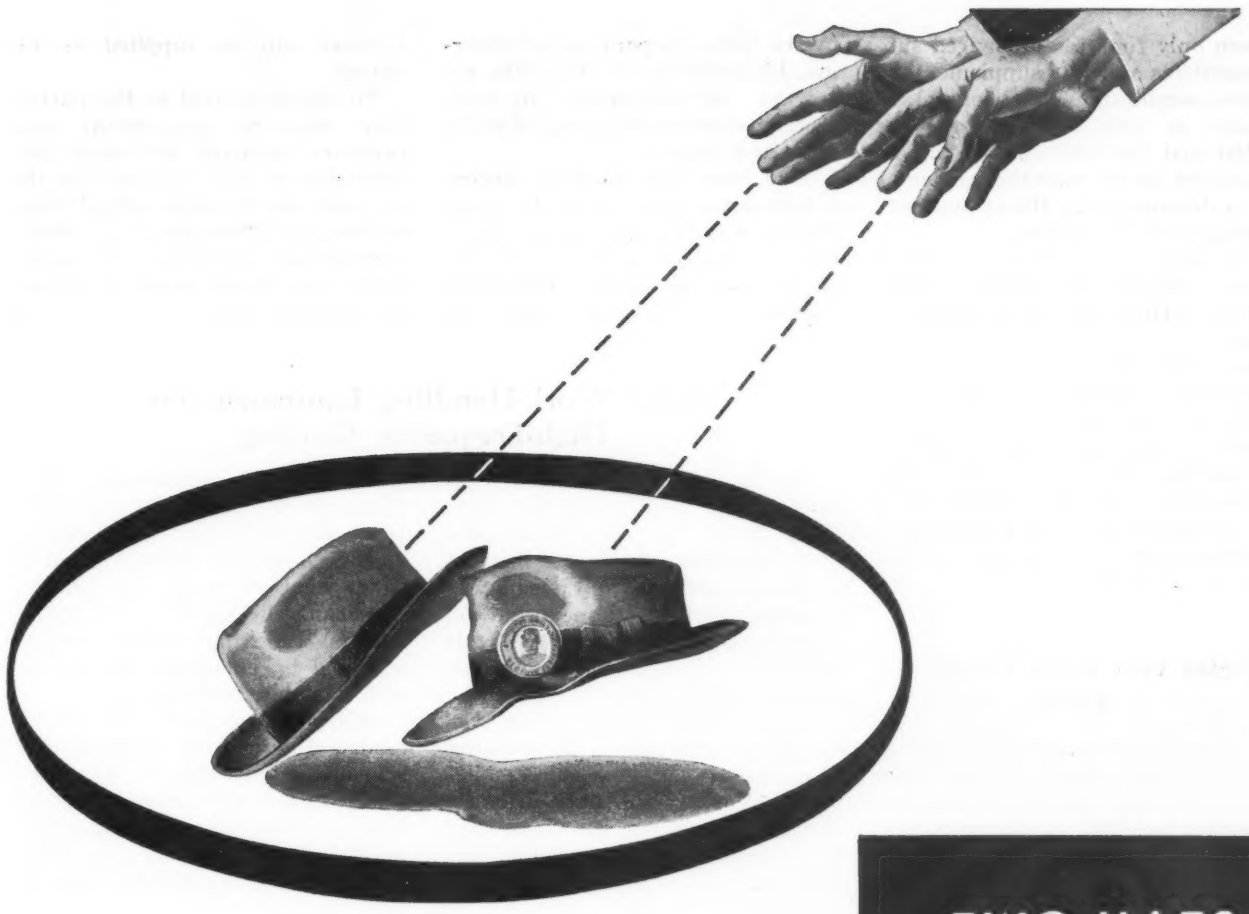
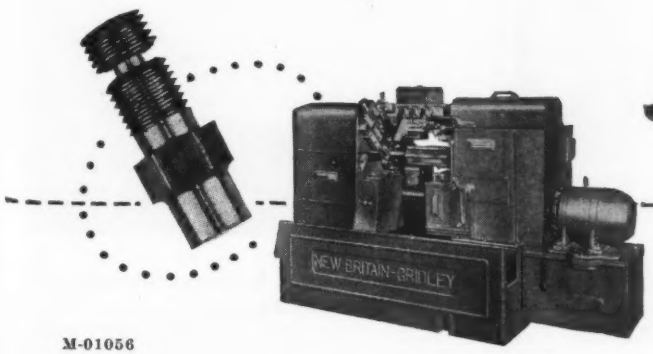


TWO HATS IN THE SAME RING

ENLIGHTENED labor leadership and enlightened management have come to share a vital area of common agreement: That wages come from earnings . . . that earnings come from greater sales . . . that increased sales come from lowered costs . . . that lowered costs come from more efficient production.

Therefore, the new, more efficient machines, better tools, improved methods are the great symbols of our common hope for the future. To management, the duty of providing the means. To hourly rated employees, the duty of making the fullest use of them.

EXAMPLE: A further operation to remove the protruding metal at the center of the head of the piece illustrated would slow down production and increase costs. As the job is produced on a Model 60 New Britain Screw Machine, a rotating pick-off spindle prevents the piece from twisting off before the cut-off tool has finished its travel, leaving the surface smooth to the manufacturer's requirements as the unretouched photo shows. The resulting production rate of 431 finished pieces per hour is a good example of lowering costs without lowering *any* standards, for the benefit of all.



M-01056

New Britain
Automatics

THE NEW BRITAIN MACHINE COMPANY
NEW BRITAIN-GRIDLEY MACHINE DIVISION
NEW BRITAIN, CONNECTICUT

from only four factory-wired sub-assemblies and two supplementary sub-assemblies. This control is made in two frame sizes—the 1200 and the 600—which can be mounted on or near the welder or at a distance with the adjustment controls at the welder.

A line of synchronous, precision, alternating-current resistance welding controls available in factory-assembled packages has also been announced by the Westinghouse Electric Corporation. This new line, known as "Synchro-Trol," comprises eight factory-assembled sub-units and five supplementary sub-units, from which it is possible to make hundreds of combinations for timing and sequence control. 85

Selas Gas Heat-Treating Table

Annealing, hardening, silver-brazing, soft-soldering, and other heat-treating operations can be handled quickly and economically at production speeds on a new heat-treating table brought out by the Selas Corporation of America, Philadelphia 34, Pa. The revolving variable-speed jig-table accommodates work-pieces of many sizes and shapes.

Two Superheat burners having a turn-down ratio of 40 to 1 are employed on this equipment. These burners can be accurately adjusted to any position. Additional burners or different types of burners can be supplied as required.

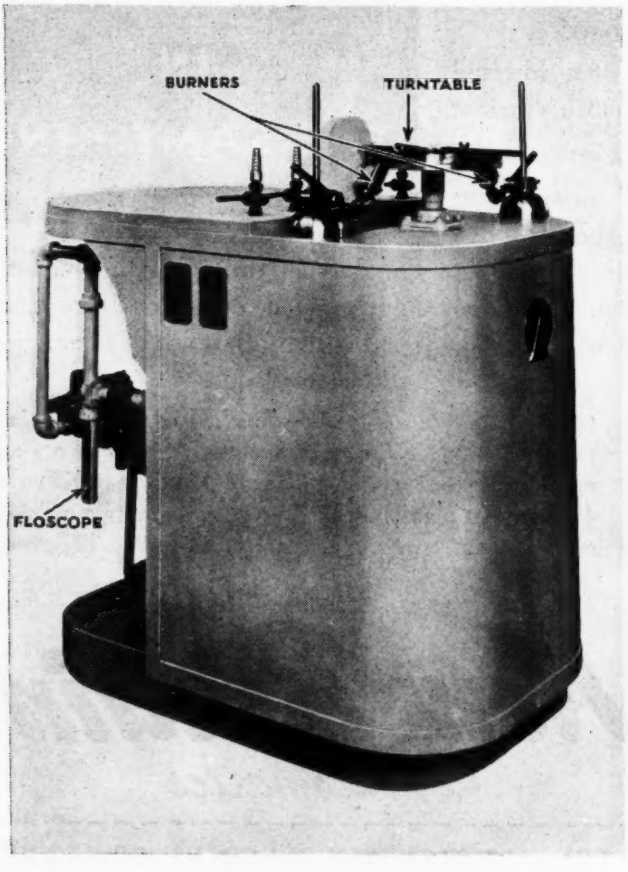
To maintain fuel at the particular mixture proportions and pressure required for each job, provision is made for passing the air and gas through visual flowmeters, or "Floscopes," to a Selas combustion controller. An automatic fire check serves to guard the mixture line. 86

Lepel Work-Handling Equipment for High-Frequency Heating

Lepel High Frequency Laboratories, Inc., 39 W. 60th St., New York 23, N. Y., have announced two additions to their line of handling devices for production soldering, brazing, annealing, and hardening—the indexing table shown in Fig. 1 and the conveyor belt table illustrated in Fig. 2.

The indexing table, which was developed particularly for heating parts requiring an accurate heat pattern, moves the part into the heating position; the load coil then descends to surround the part, and the heating cycle is carried out—all automatically. This table can be used with any high-frequency converter or generator, and is equipped with a built-in timer that controls the heating time and the power of the converter. Indexing speed can be adjusted by changing the setting of a variable-speed drive.

The conveyor belt table is intended for general high-production operations, and its speed can be regulated over a wide range. The conveyor belt is designed to permit the fastening of interchangeable supports that can be



Gas Heat-treating Table Brought out by the Selas Corporation of America

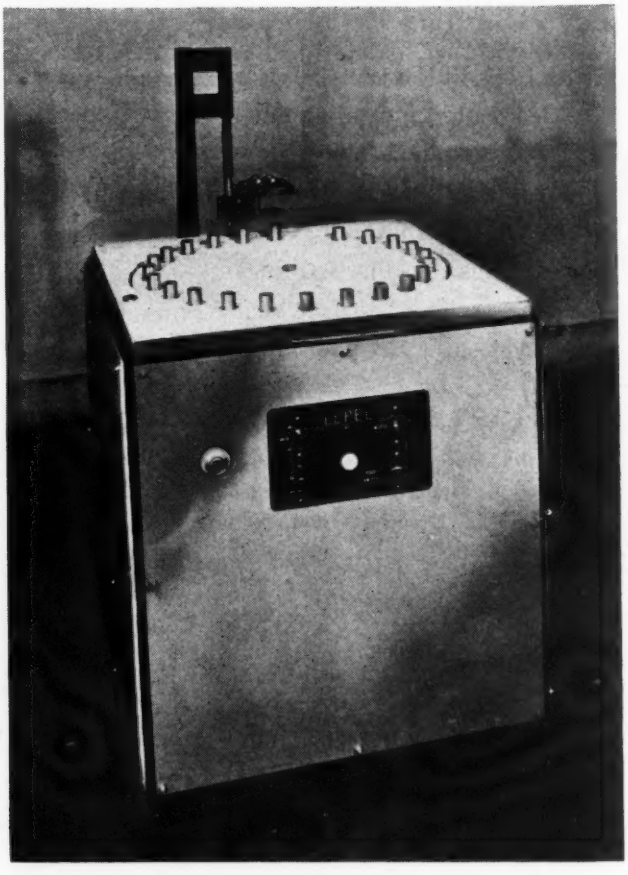
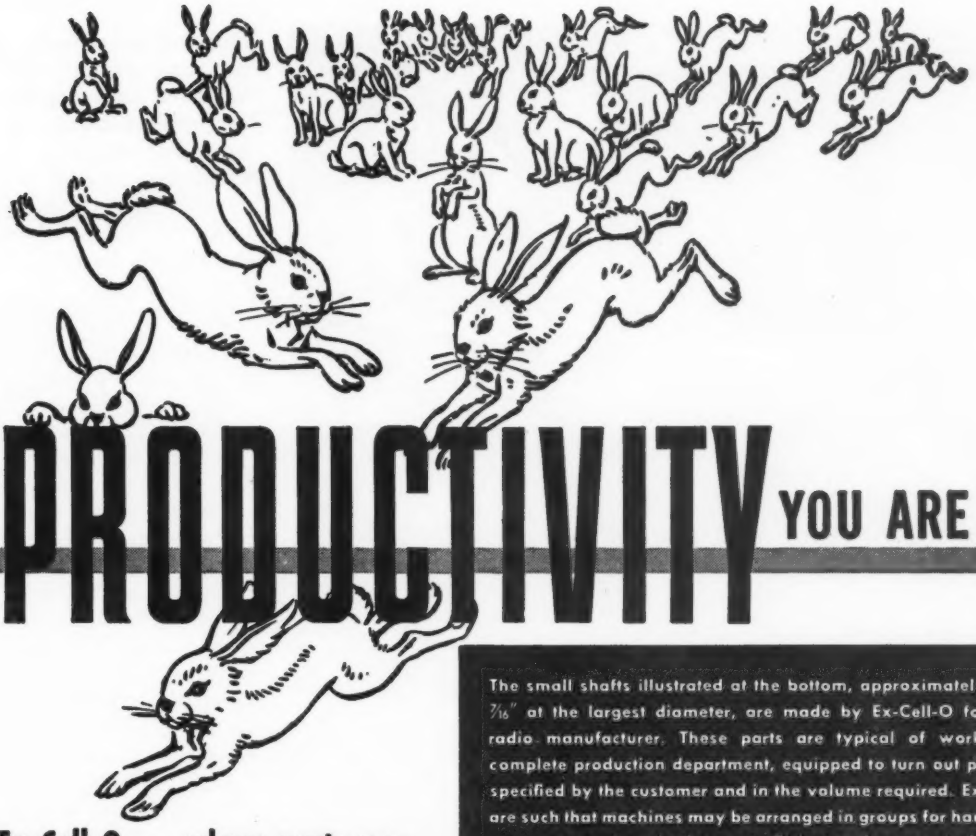


Fig. 1. Lepel Variable-speed Indexing Table for High-frequency Heating

To obtain additional information on equipment described on this page, see lower part of page 218.



IF IT'S PRODUCTIVITY YOU ARE AFTER

Consider Ex-Cell-O . . . where parts production is keyed to *your* exact requirements

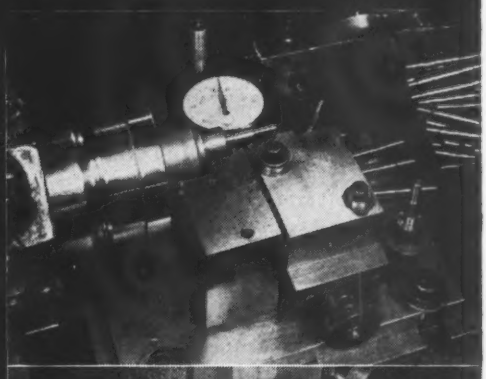
The long years of engineering experience . . . the modern and complete facilities . . . the manufacturing "know how" . . . that have made Ex-Cell-O an outstanding name in the metal-working industry . . . can help you solve your problem if you are in need of accurate parts and sub-assemblies for your product, whether old or new. Ex-Cell-O, *with machining, heat-treating, grinding and sub-assembling facilities all under one management,* offers you many practical advantages. Send your print or part to Ex-Cell-O in Detroit today, or get in touch with any member of Ex-Cell-O's field engineering staff in thirty-two leading industrial centers in the United States and Canada.

XLO
EX-CELL-O for PRECISION

Modern machine tools mean *"more goods for more people at lower prices"* . . . see 1947 Machine Tool Show in Chicago in September!

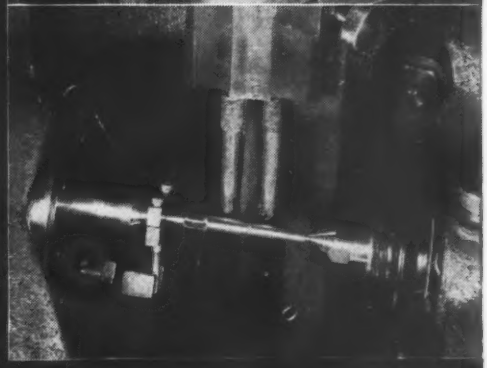
The small shafts illustrated at the bottom, approximately 3½" long and 7/16" at the largest diameter, are made by Ex-Cell-O for a well-known radio manufacturer. These parts are typical of work in Ex-Cell-O's complete production department, equipped to turn out parts to the limits specified by the customer and in the volume required. Ex-Cell-O facilities are such that machines may be arranged in groups for handling successive operations in the most efficient and economical manner.

★



To right: Grooving radio shafts on Ex-Cell-O Precision Boring Machine. Widths of grooves are held within .004" and distance between grooves is held within .005".

★



To right: On an Ex-Cell-O Style 33 Precision Thread Grinder a 3/8-20 thread is ground on the parts after they have been hardened.

★

To right: Hardened and ground precision radio shafts, referred to above, made in Ex-Cell-O's Parts Production Department.

47—3

EX-CELL-O CORPORATION DETROIT 6 MICHIGAN

MANUFACTURERS OF PRECISION MACHINE TOOLS AND CUTTING TOOLS • PRODUCTION PARTS AND SUB-ASSEMBLIES

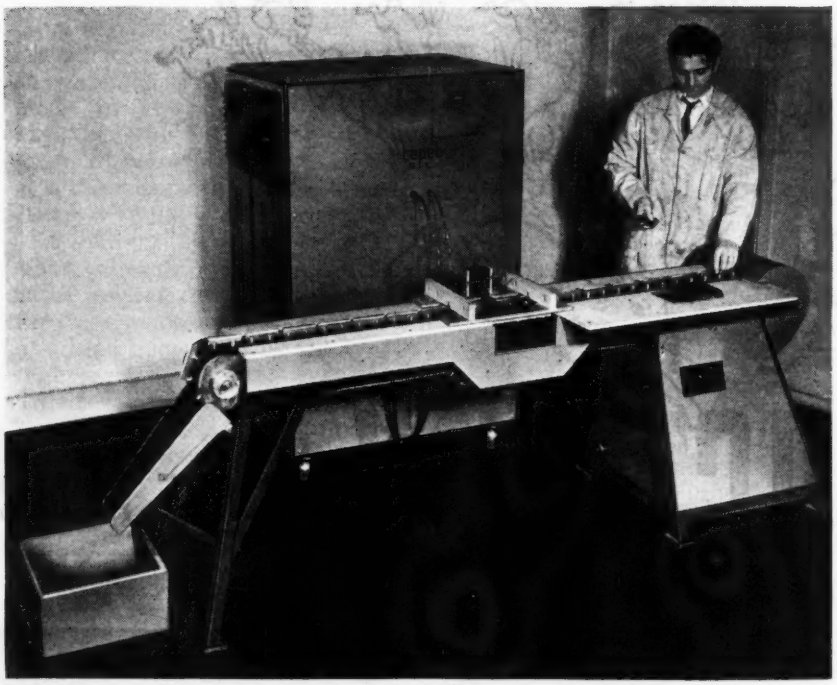


Fig. 2. Lepel Conveyor Belt Table for General High-frequency Soldering, Brazing, and Heat-treating Operations

used to hold work-pieces of various shapes in position. The load coil shown in the center of the table is movable and can be placed at the extreme end of the conveyor belt for hardening applications, at which point the part falls directly into a quenching tank. 87

Oakite Improved Steam-Cleaning Unit

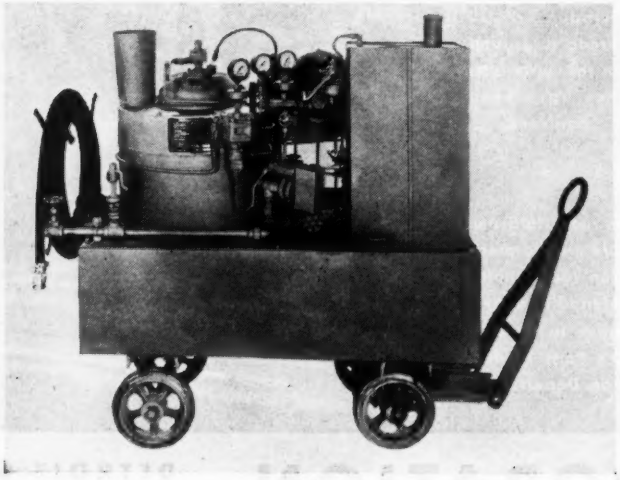
An improved Oakite - vapor, steam-cleaning unit for metal-cleaning and paint-stripping operations on industrial equipment is now available from Oakite Products, Inc., 126 Thames St., New York 6, N. Y. This unit comprises an enclosed-coil type, down-draft flame steam generator which delivers a hot vaporized spray in either a wet or a dry state under pressures up to 200 pounds per square inch, which will operate two steam guns simultaneously.

Provision is made for completely automatic operation of this new unit. The cleaning solution is aspirated through the steam gun from a separate solution tank, by-passing the steam coils, so that coil clogging by the cleaning compound is eliminated. The unit is available as a stationary model; mounted on wheels, as illustrated, for use around the shop; and mounted on a trailer type chassis for outside work. It is generally equipped with a 3/4-H.P., 60-cycle, 110- to 220-volt alternating-current motor, but where electric power is not available, a gasoline engine can be used. 88

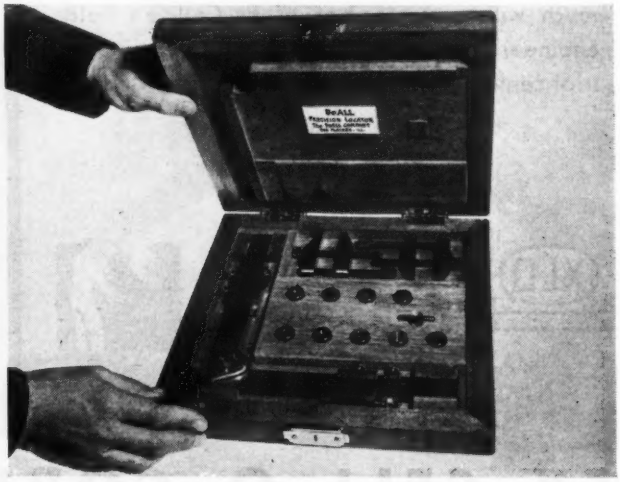
DoAll Precision Hole Locator

The DoAll Co., 254 N. Laurel Ave., Des Plaines, Ill., has brought out a precision device for the accurate locating of holes in drilling jigs, dies, precision parts, and similar work. It consists essentially of two hardened and ground tool-steel arms located at right angles to each other within limits of 30 seconds of arc. At the exact vertex of the right angle formed by the two arms is a ground tapered hole, in which hardened and ground drill bushings are held by a bridge type clamp. Each arm has a graduated vernier stop-slide.

To locate a center, two sides of the work-piece are used as reference surfaces for the vernier slides. When the slides are set to the required dimensions and the locator placed on the work-piece with the vernier stops against the reference slides of the work, the center of the tapered hole will be located in the exact position desired. The locator is then clamped to the work. By inserting the 1/4-inch precision ground drill bushing furnished with the locator, and by using the special center-punch, the desired center can be punched in the work. 89



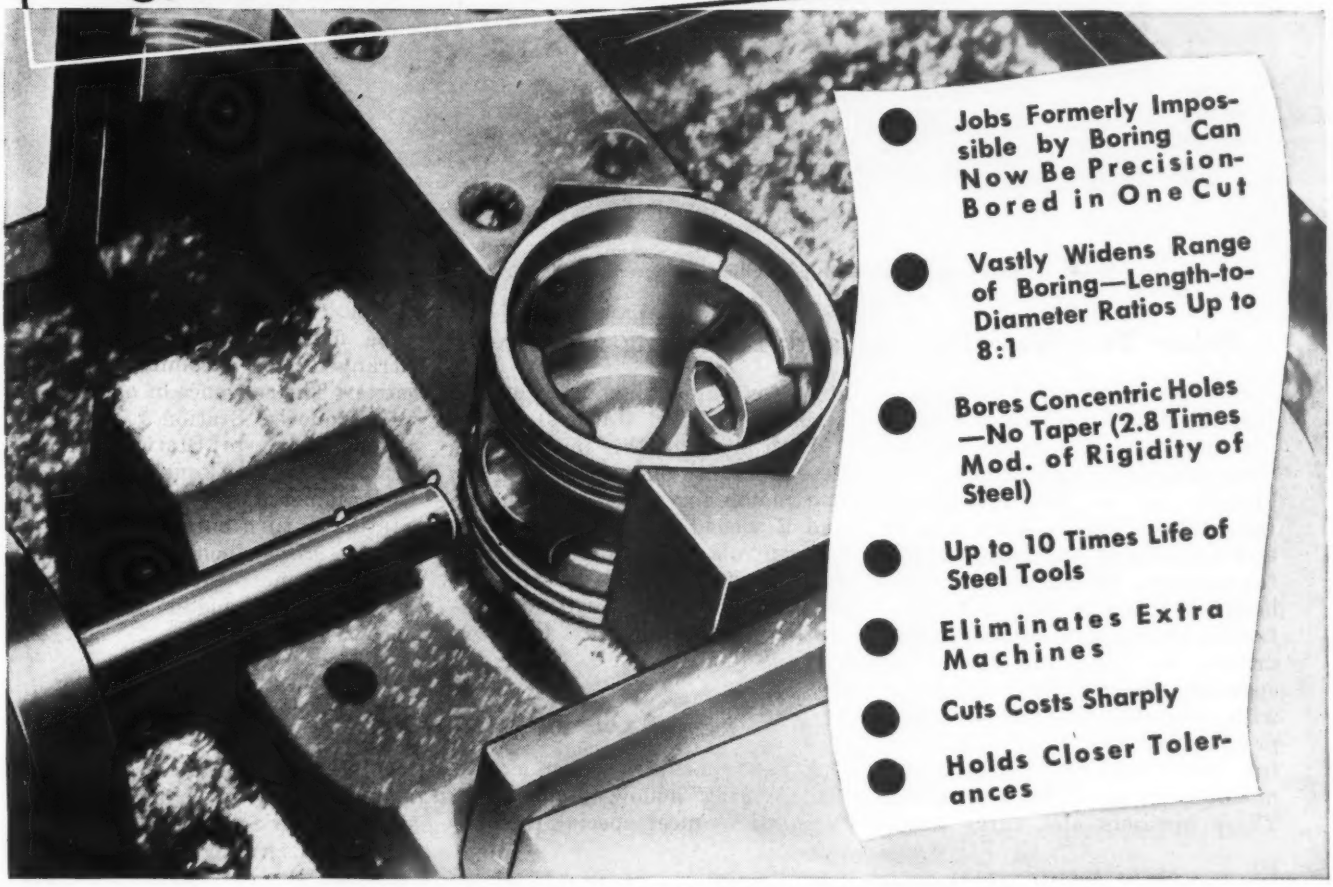
Oakite-vapor Steam-cleaning Unit Mounted on Wheels



Precision Hole Locator Brought out by the DoAll Co.

To obtain additional information on equipment described on this page, see lower part of page 218.

New BORING BAR OF SOLID CARBOLOY GIVES YOU THESE 7 ADVANTAGES:



Production doubled, 13-micro inch finish obtained on aluminum piston job.

With this new Carboloy Company development you can do more jobs *by boring*—get precision finishes in one cut—do jobs faster, cheaper. For example:

An automobile company, battling poor finish on die-cast aluminum pistons, replaced steel boring bars with the new Solid Carboloy boring bar. New set-up made possible boring completely through piston in one pass (due to 2.8 times greater rigidity of Carboloy)—eliminated need for double-end machine—produced 13-micro inch finish—cut floor-to-floor time—DOUBLED production.

These new solid Carboloy boring bars and tools can produce results like these in *your* plant! Write for free folder, today.

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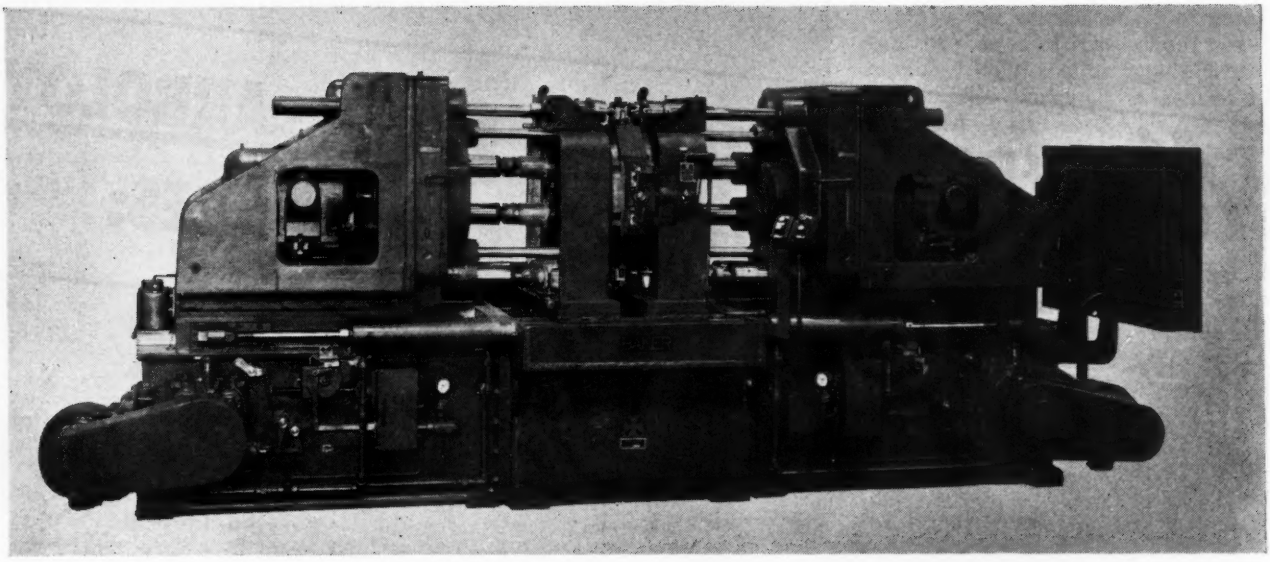


Baker Turning and Threading Machine Designed for Operations on Steering-knuckle Pins

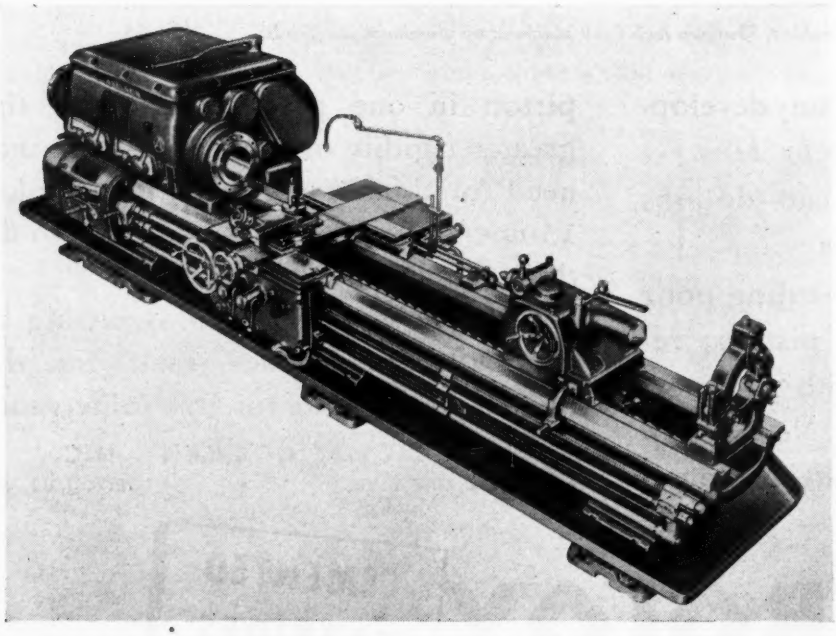
Baker Two-Way Turning and Threading Machine

A two-way, opposed-head, floor type machine for production turning and threading operations on steering-knuckle pins has been brought out by Baker Brothers, Inc., Toledo, Ohio. Each unit of this machine is furnished with a four-spindle, fixed-center multiple head for hollow milling and chamfering. Heads with two additional drivers for operating lead-screw spindles for external threading with collapsible die-heads are also provided on each unit. Lead-nuts for the threading operation are mounted on the fixture uprights. These uprights also carry bushings for supporting tools at the second and third stations.

Both heads of this machine are arranged with double motor drive, one motor for the four spindles, and a second motor with reversing controls for advance and withdrawal of the lead-screw. The machine is furnished with a four-station hand-indexed trunnion type fixture, each station being arranged to accommodate two parts. The sequence of operations is as follows: Station 1, load and unload two parts; Station 2, chamfer both ends of knuckle pin (7/8 inch diameter by 7/32 inch deep); Station 3, turn outside to a diameter of 0.7855 inch for a depth of 1 3/16 inches; Station 4, thread 0.7855 inch diameter to a depth of 1 1/8 inches. 90

Axelson Hollow-Spindle Lathe

A new machine known as the "Oil Country" hollow-spindle lathe, designed to meet special requirements in the oil industry, is being manufactured in a 20-inch size with twenty-four speeds and in 25-inch size with sixteen speeds by the Axelson Mfg. Co., Los Angeles 11, Calif.



Axelson Hollow-spindle Lathe for Use in the Oil Industry

The lead-screws of these lathes are turned and ground before threading. Preloaded and adjustable thrust bearings are provided at each end of the lead-screws. The feed-rod is used for all work except threading. The headstock case is a one-piece oil-tight unit, the hollow spindle being mounted in two sets of Timken precision bearings. The forged alloy-steel hollow spindle is ground to close tolerances, and all gears in the spindle driving train are of alloy steel, carburized, hardened, and profile ground.

Power is transmitted from the motor by means of multiple-plate forward and reverse rotation clutches. The automatic spindle brake is synchronized with the main driving clutches for rapid stopping and reversing. 91

To obtain additional information on equipment described on this page, see lower part of page 218.

there's a place for YOU at the

GISHOLT "ROUND TABLE"

Take your place here—whenever you seek new and better methods of producing round or semi-round parts! For this Gisholt "Round Table" symbolizes more than 50 years of collective experience in the manufacture and applications of metal-working equipment. And that experience—practical, authoritative—is yours to use in saving production time and cost.

your problem is carefully studied

Perhaps the solution is already waiting for you. If not, you may be sure that Gisholt's specialists will consider it as their own problem. Whether it involves large or small lot production, they will suggest the methods and equipment best suited to your individual needs.

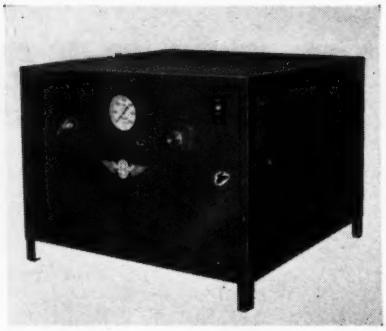
and the most practical solution is found in the broad Gisholt line

Here you may be sure of unbiased judgment, for Gisholt's interests and experience are not limited to one or two classes of machines. Here are length and breadth of experience in machining, surface-finishing and balancing round or semi-round parts that are best evidenced in the completeness of the Gisholt line itself.

GISHOLT MACHINE COMPANY

Madison 3 • Wisconsin

THE GISHOLT ROUND TABLE *represents the collective experience of leading specialists in the machining, surface-finishing, and balancing of round and semi-round parts. We welcome your problems.*



Greer Hydraulic Power Pack

Greer Hydraulic Power Pack

Greer Hydraulics, Inc., 454 Eighteenth St., Brooklyn 15, N. Y., has announced a new addition to its line of hydraulic power packs. The new unit is completely self-contained, and can be used to supply large volumes of fluid under controlled pressure for the operation of presses and similar machines utilizing hydraulic fluid for power. An outstanding feature of this machine is the small-size electric motor and pump used to store fluid under pressure in a 10-gallon storage chamber for instantaneous release when required.

The fluid from this power pack is supplied to the press during the work cycle. At the end of the cycle, the fluid is returned automatically to the reservoir and the cycle repeated at regular intervals. The power pack is compactly constructed, occupying a minimum floor space. 92

Light-Weight All-Plastic Safety Goggle

A new light-weight all-plastic safety goggle with air-conditioned eye-cups that are said to reduce fogging of the lenses is a recent product of the American Optical Co., Southbridge, Mass. The plastic lenses of this goggle are designed to protect the eyes against particles striking from any direction when the wearer is performing such operations as chipping, grinding, babbitting, riveting, and cutting or grinding metal or other materials with power or hand tools.

Light-weight Plastic Goggle Made by American Optical Co.

Both clear and green lenses are available in these goggles. Provision is made for quick replacement of the lenses. The frame is available in clear or green color, and can be worn over most types of prescription glasses. 93

Revolute Automatic Blueprinting Machine and Ammonia Developer

The Paragon-Revolute Corporation, 77 South Ave., Rochester 4, N. Y., has announced a new model continuous blueprinting machine designed for the high-speed production of blueprints, whiteprints, Vandyke prints, and blueline prints. This machine utilizes the Revolute revolving contact principle to insure slip-free and static-free contact between the tracing and the sensitized material.

The machine is equipped with either a 75- or a 95-watt quartz lamp. An aperture control is provided for governing the exposure area of the contact glass. The driving mechanism provides an infinite number of speeds from 6 inches to 32 feet per minute. A double chemical applicator makes possible the complete submersion of prints in the chemical solution to insure thorough developing and fixing at any speed. Improved equipment for washing and drying the prints is employed.

This company has also brought out a new print developer called the "Revolute A Finisher," designed to handle all ammonia type diazo papers or special prints. This new developer is equipped with an interval timer for temperature control. 94

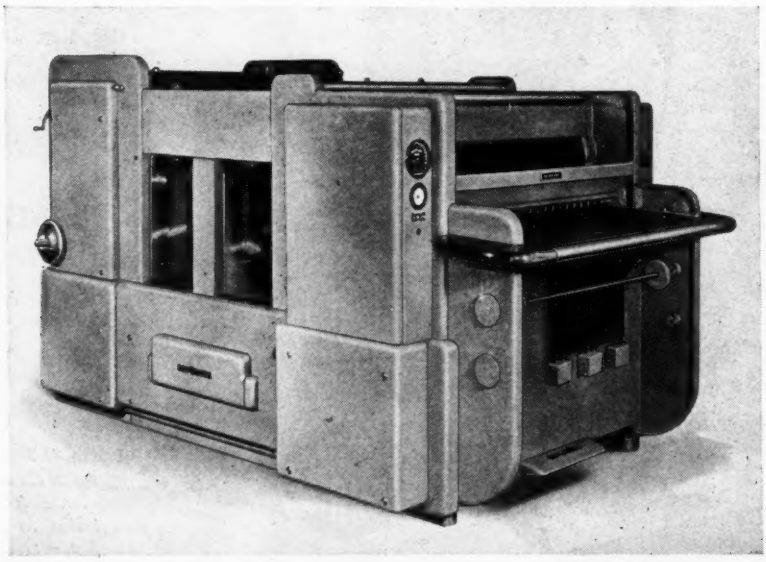


Fig. 1. Paragon-Revolute Automatic Blueprinting Machine

Fig. 2. Paragon-Revolute Developer

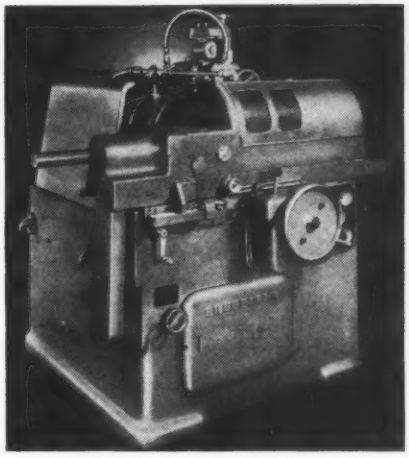
To obtain additional information on equipment described on this page, see lower part of page 218.

SHEFFIELD MACHINE TOOL DATA

TFG - #123-4

NEW PRECISION ANNULAR FORM GRINDER FOR CRUSHTRUE GRINDING

Sheffield announces a Precision Annular Form Grinder as an addition to its line of precision grinders. This new machine utilizes the Crushtrue principle of wheel dressing for the rapid production of cylindrical forms such as circular form tools, crusher rolls, ball bearing races and seals, shift grooves in automotive and farm implement transmission gears, and other annular forms of intricate and precise profile.



MACHINE FEATURES:

Live or Dead Center Workhead
Infinitely variable work speeds
Semi-Automatic Power Crushing
Wheels form dressed up to 2" face
Swings 7" work 12" between centers
Precision work spacing device

Write for Engineering Data TFG 123 and 124

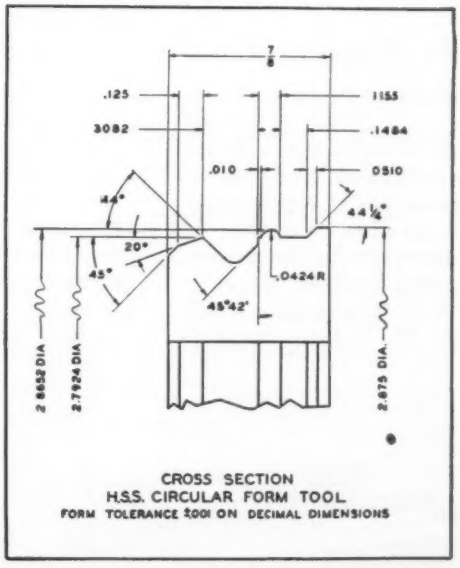
GRINDING TIME CUT FROM 4½ HOURS TO 4 MINUTES

This circular tool has a contour involving a blend of radii, straight sides, angles and flats. Prior to using the Crushtrued full form wheel, the work had been made on universal cylindrical grinders by toolroom procedure in lots of 15 to 30, and the grinding time of 4½ to 5 hours per tool was considered top performance.

A master Crushtrue Roll, made on the Micro-Form Grinder, was used to true the wheel on the Precision Annular Form Grinder shown above.

Grinding from the solid required 13 minutes. Grinding on preformed stock having approximately .020" on a side required less than four minutes.

The time required to make the Crushtrue roll compares with that of making the circular tool by conventional means. Therefore, the crush grinding process would show savings that become phenomenal as the quantities increase.



CROSS SECTION
H.S.S. CIRCULAR FORM TOOL
FORM TOLERANCE .0001 ON DECIMAL DIMENSIONS

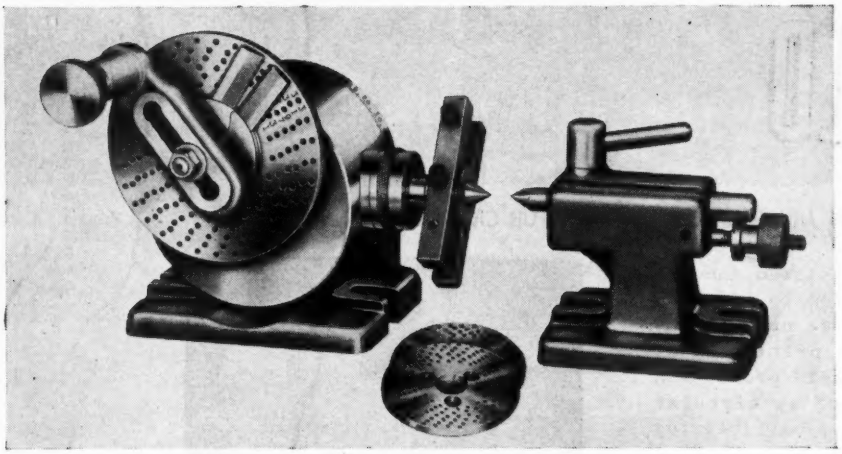
Previous grinding time	270 minutes
Crushtrue grinding time	4 minutes
Time saving	266 minutes
Percent Time Saved 98.5%	

Thousands of other production cost problems can be answered satisfactorily by crush grinding with Sheffield equipment. Write for Bulletins M-100-145 and M-120-146.

THE SHEFFIELD CORPORATION

Dayton 1, Ohio, U.S.A.

MACHINE TOOLS · GAGES · MEASURING INSTRUMENTS · CONTRACT SERVICES



Universal Dividing Head for Small Milling Machines Brought out by the L-W Chuck Co.

Universal Dividing Head Designed for Small Work

A 6 1/2-inch universal dividing head has just been added to the line of equipment made by the L-W Chuck Co., 42 S. St. Clair St., Toledo, Ohio. The head and the tailstock of this equipment are designed to withstand hard, continual use on the smaller sizes of milling machines. The spindle has a tapered bearing, and the head can be tilted to an angle of more than 90 degrees. The dividing head has three indexing plates for spacing up to 380 divisions. 95

Pratt & Whitney Electro-Mechanical Lead Tester

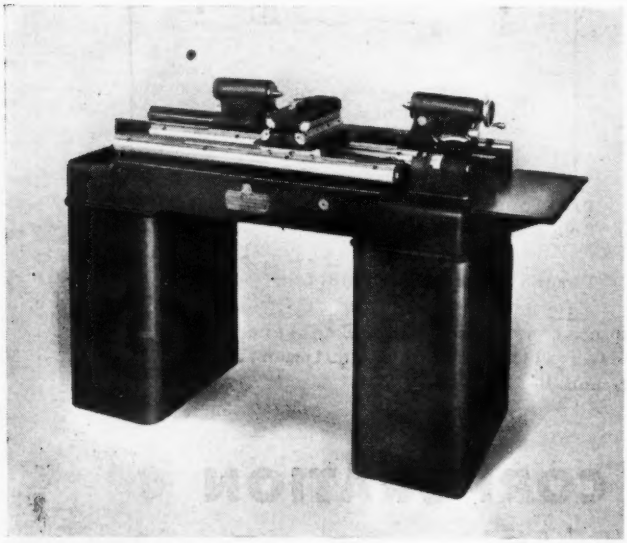
Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford 1, Conn., has brought out a Model C electro-mechanical lead tester for checking errors of commercial threads. Work-pieces up to 10 inches in diameter by 30 inches long can be held between the tailstock centers of this tester. Work longer than 30 inches, ranging from 1/2 inch to 3 inches in diameter, can be checked by using V-block supports. Threads up to 26 inches in length can be checked in one set-up.

The measuring head consists of a standard Pratt & Whitney Supermicrometer headstock with a 1-inch spindle travel, mounted on a special base. The spindle is graduated in increments of 0.050 inch. The dial has fifty graduations of 0.001 inch, with a vernier which reads directly to 0.0001 inch. This spindle serves to subdivide any given inch along the work, while even inch increments are obtained by using precision measuring blocks or rods. The headstock permits taking an accurate reading for each thread.

The thread locating head consists of a standard Electrolimit universal circuit head with ball-point holder and ball point. This head operates the meter located on the measuring head. By turning the dividing screw on the measuring head, the ball point is readily centered in the vee of the thread. The desired measuring point is reached when the meter indicates zero, the lead then being read directly on the measuring head. The carriage is equipped with a counterweight, which keeps the pressure against the end measures and measuring head constant. An automatic safety stop is provided to eliminate danger of the carriage striking the measuring-head spindle anvil and damaging the precision measuring screw. 96

Peterson Surface Grinder

No set-up is necessary for the rapid grinding of flat-surface castings to an accuracy of 0.001 inch on a new surface grinder brought out by the Peterson Welding Laboratories, 1423 Virginia, Kansas City 6, Mo., for use in



Electro-mechanical Lead Tester Brought out by Pratt & Whitney

Surface Grinding Machine Brought out by Peterson Welding Laboratories

To obtain additional information on equipment described on this page, see lower part of page 218.

"Arc Booster" Simplifies AC Welding

Lincoln Electric announces new industrial type AC welder

A NEW heavy-duty transformer type welder, the "Fleet-Arc" has been introduced by The Lincoln Electric Company which improves AC welding by affording greater ease of arc striking, deeper penetration at the start, wider range of output, greater economy of operation and greater safety. It is applicable to a wide range of applications throughout industry.

A feature known as the "Arc Booster" gives the arc a burst of current the instant the electrode touches the work, starting the arc automatically. The current then returns in a fraction of a second to the amount set for the job. A selector switch provides adjustment of the booster current for any degree of arc striking intensity to suit the job.

Improves Penetration at Start

To improve penetration at the start of a bead, the "Arc Booster" of this new welder can be set to dig in with deep penetration. This is especially important for tack welds and short beads.

Improves Arc Characteristics

The welder has a reactor type of control which is a free circuit, designed for high responsiveness to changing arc conditions. It is separate from the main transformer which is designed for high efficiency. This design gives high arc sensitivity for maximum ease and speed of welding under all conditions; it makes possible an exceptionally wide range of output; and it improves power efficiency.

Current Adjustment is Continuous

The rotating reactor control provides step-less, smooth, accurate adjustment of welding current over the entire range of the welder. The operator simply turns a hand wheel. A double reduction chain drive makes it easy to turn the control and requires a minimum number of turns of the handle to cover the range. The amperage is indicated on a dial on the front of the welder.

The reactor current control is held in position by rugged cone brakes, preventing vibration and wear of the control mechanism.

Increases Safety

The open circuit voltage of the "Fleet-Arc" AC welders never exceeds 63 to 70 volts (depending on welder capacity). This eliminates the hazards of the high open circuit voltages which are used in the usual AC welders to improve arc striking.

Reduces Idle Power Consumption

The independent control circuit eliminates the need for high open circuit voltage, contributes to higher power factor. By reducing amount of condensers needed as much as 66%, this new welder minimizes idle power input.

Is Completely Self-Protected

A thermostatic device protects the windings of the welder from damage due to overheating, opening the welder's magnetic starter under such conditions. This feature permits the welder to be used at high current values for sustained periods without danger of burn-out.

Immediate Delivery

The new welders are available from stock in ratings of 200, 300 and 500 amperes. Complete information on the "Fleet-Arc" AC Welders is given in Bul. 366 which may be had by writing The Lincoln Electric Company, Dept. 224, Cleveland 1, Ohio.

Advertisement

machine shops and foundries. This machine is designed to permit an unskilled operator to perform accurate surface grinding operations by simply guiding the casting back and forth across the grinding wheel. The face of the surface grinding wheel and the table surface are located in a horizontal plane, as shown in the illustration.

Tip-toe control by means of a spider wheel permits the operator to raise the stone a maximum of 2 inches to the grinding level, leaving both hands free for handling the work. A 16-inch suction fan, bolted to the under side of the grinding wheel, pulls the grinding dust down and deposits it in two dust collectors. The grinder is available in two models, one equipped with a 14-inch wheel and a 3-H.P. motor; and the other equipped with a 16-inch wheel and a 5-H.P. motor. 97

Noble & Westbrook Tube-Marking Machine

The Noble & Westbrook Mfg. Co., 15 Westbrook St., East Hartford 8, Conn., has brought out a machine for marking designs, names, and other inscriptions permanently on thin-walled metal cases such as shown in the illustration. Other similar parts can also be marked with this dial-fed machine. Thin-walled tubes of this kind require an internal mandrel support, and a pressure-indicating dial is necessary.

The work-carrying dial is provided with ten loading stations, on which the parts are placed by hand. This dial revolves continuously, the work being rolled between the steel marking die and the pressure dial. Provision is made for quick changing of mandrels for work of various sizes.

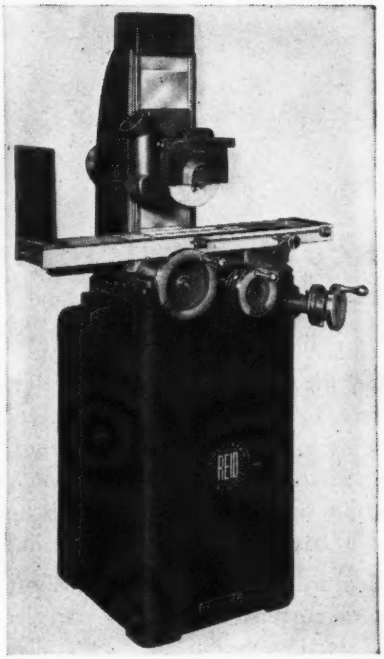
With this machine, it is possible to mark several lines of lettering, either lengthwise or around the part or any type of design can be marked on the outer surface of the tube. The machine is regularly made for pieces with diameters up to approximately 3/4 inch, but it can also be furnished for larger diameters. Production ranges from 60 to 80 pieces per minute. The machine weighs about 500 pounds, and requires a floor space of 18 by 24 inches. 98

Reid Precision Surface Grinder

A surface grinder designed to handle work of comparatively small size that must be ground to close tolerances, with a fine finish, has been announced by Reid Brothers Co., Inc., Beverly, Mass. This machine is adapted for finishing tools, gages, dies, chasers, and similar work.

The machine is equipped with a 7- by 1/2-inch wheel, and will grind work 4 by 8 by 9 1/8 inches high. The wheel-spindle center can be elevated to a height of 12 5/8 inches above the worktable. The spindle is driven at a speed of 3450 R.P.M. by a 3/4-H.P. motor. The elevating handwheel has 0.0005-inch graduations, and the cross-feed handwheel has 0.001-inch graduations. Adjustable graduated index dials on these handwheels allow them to be easily returned to the zero settings.

Lubrication of the machine is



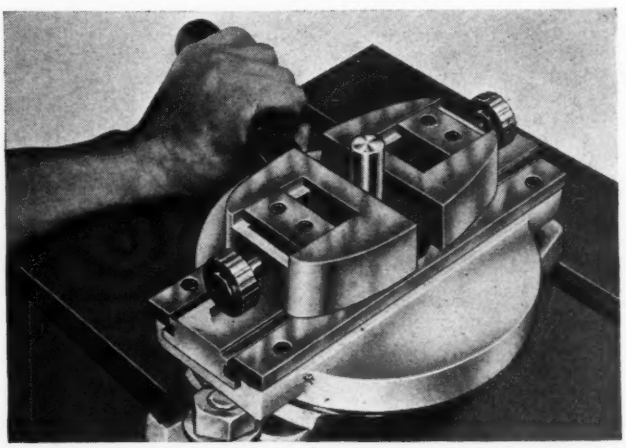
Reid Precision Surface Grinder

accomplished by easily accessible Zerk fittings and oil-cups. The machine weighs approximately 900 pounds, occupies a floor space of 56 by 36 inches, and is 66 1/2 inches high. 99

Williams Self-Centering Vise

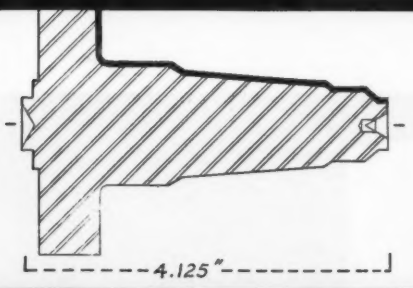
A self-centering double cam-actuated vise, designed to center work for drilling or milling operations regardless of dimensional variations, has been introduced by the Williams Products Co., Middletown, Conn. The self-centering feature of this vise is of particular advantage in the case of castings, forgings, and similar types of unmachined work. Fast, effi-

Noble & Westbrook Tube-marking Machine

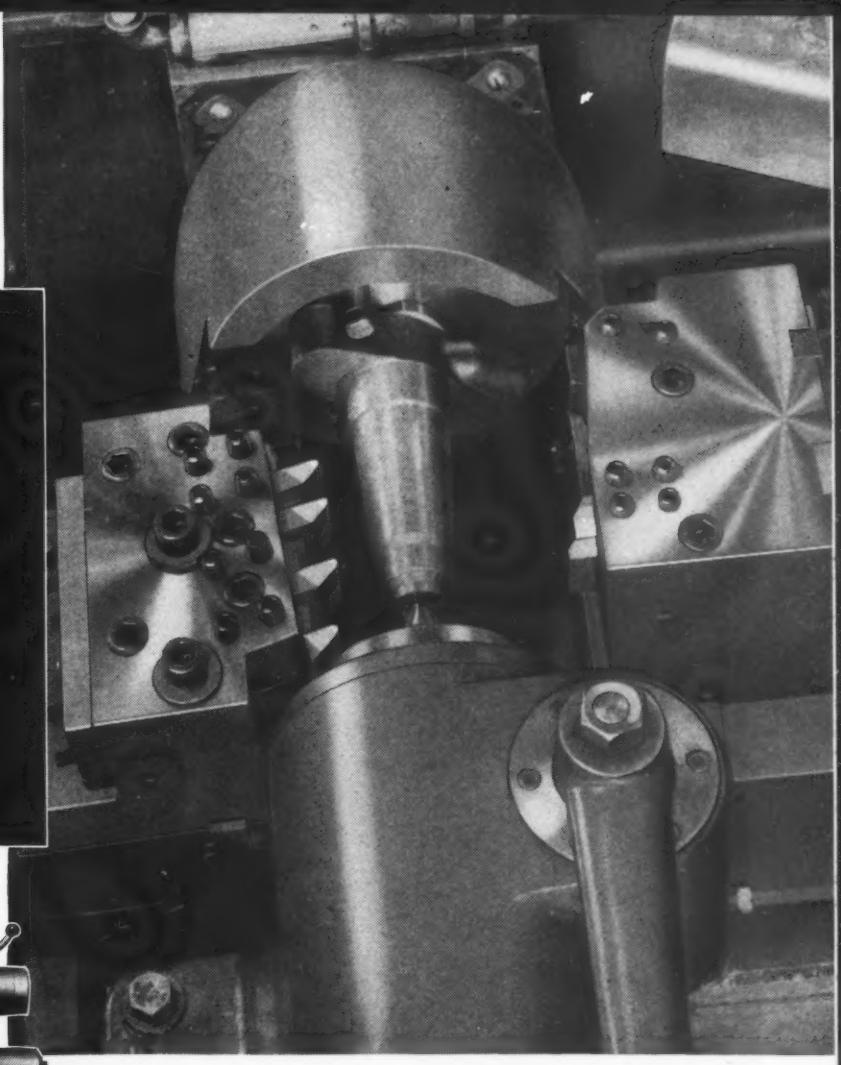


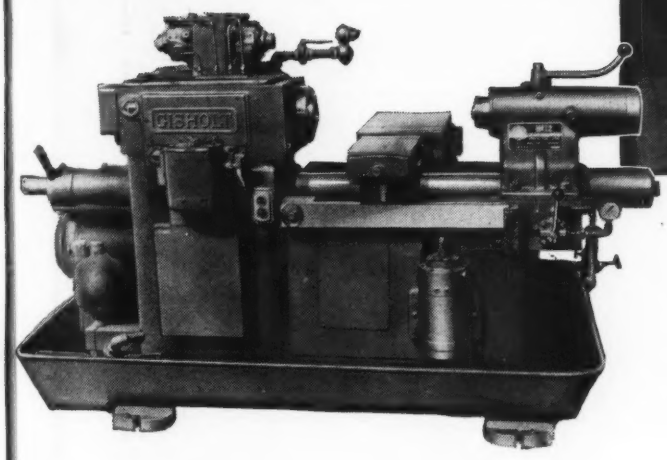
Williams Cam-actuated Self-centering Vise

To obtain additional information on equipment described on this page, see lower part of page 218.



take a *Short Cut* on all cuts





with the GISHOLT *Hydraulic Automatic Lathe*

HERE'S a typical example of the ability of the Gisholt No. 12 Hydraulic Lathe to profitably combine a number of cuts in one operation.

In the machining of a type of Diesel Engine Injector Body (material—SAE 4150 steel forging, in lots of about 1000), *one* No. 12 operation is accomplishing the same work that formerly required two operations, one on each of two less versatile automatic lathes. And this work, which used to take about 5 minutes per piece to perform, is now completed in *1.5 minutes on the No. 12.*

Comparable savings are being realized on two other similar types of injector bodies, with rapid changeover, through the machining advantages of the Gisholt Hydraulic Lathe.

One reason so many jobs are done faster on the Gisholt No. 12 lies in the wide latitude of tooling arrangements it makes possible. Operations such as taper turning, forming, angular facing, constant speed radius cutting and intermittent facing can be efficiently combined with orthodox turning, facing, boring, and grooving.

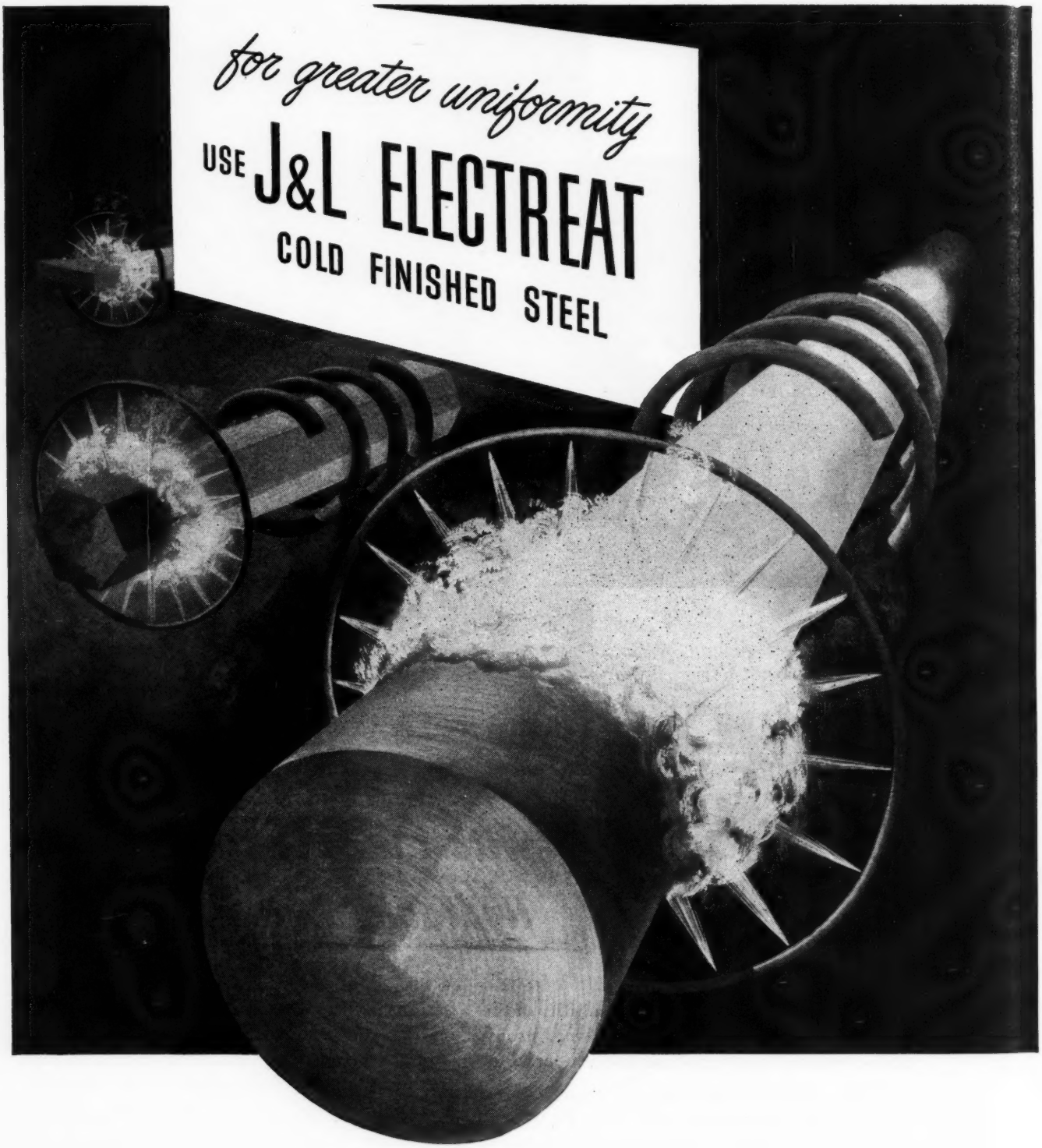
Investigate the characteristics of this advanced automatic lathe that give it such remarkable earning power.

GISHOLT MACHINE COMPANY

Madison 3, Wisconsin

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in the machining, surface finishing and balancing of round and semi-round parts. Your problems are welcome here.*

TURRET LATHES · AUTOMATIC LATHES · SUPERFINISHERS · BALANCERS · SPECIAL MACHINES



The new induction heating method of producing heat treated quenched and tempered cold finished steel makes possible an unusually accurate control of the process. Bars are fed individually through the coil and heated to exactly the desired temperature. They pass immediately through a cone of water sprays which is used to closely regulate the cooling. The Electreat cold finished bars produced by J&L with this process have a degree of uniformity not possible with conventional methods. Write for complete information.

J&L STEEL

JONES & LAUGHLIN STEEL CORPORATION • PITTSBURGH 30, PA.

cient operation is facilitated by one-hand operating and locking.

A 3-inch opening allows the work and chips to fall from the vise when the cam lock is released, suitable clearance being provided for placing a work-tray or chute under the vise. Specially formed jaws, which can be easily installed, are available for holding irregular-shaped parts. 100

Jacobs Small-Diameter Tap Chuck

A small-diameter chuck designed to combine accuracy, strength, and light weight is announced by the Jacobs Mfg. Co., Hartford 2, Conn. This chuck has been developed for use with tapping heads and tapping machines. The extreme lightness and small diameter of this chuck are features that serve to reduce torsional inertia, prevent tap breakage, particularly in bottom tapping operations, and allow for quicker reversing.

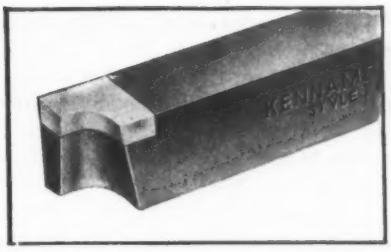
The "Rubber Flex Collet" design, as shown in the disassembly view of the illustration, is made up of several hardened steel jaws permanently bonded into a synthetic rubber body, which is resistant to heat and coolants or cutting compounds. All working surfaces of the collet are precision ground after molding, and the collet is centralized by a ground conical bore in the chuck body to assure extreme accuracy with respect to concentricity. When the cap of the chuck is screwed on the body in the tightening process, the collet is forced into the ground cone until it has a true and rigid grip on the tap shank.

Mounted within the body, yet completely detachable, are two floating jaws of heat-treated alloy steel which provide a positive drive for the square end of the tap. These jaws maintain a firm grip on the tap even though it may be off center, and they do not influence the centralizing effect of the "Rubber Flex Collet." The jaws are connected by an operating screw of socket-head design.

Tap changing with this chuck is a simple, quick operation; a quarter turn of the cap and of the screw connecting the positive driving jaws completely disengages the tap from the chuck. A new tool or tap can then be clamped in place by tightening the cap and the jaw screw. The wide range of tap sizes accommodated by the "Rubber Flex Collet" eliminates the need for single-purpose type collets for each size of tap employed. Only three of the new chucks are needed to cover a range of tap sizes from 0 machine screw taps to 5/8-inch hand taps. 101

Kennametal Internal Radius Tools

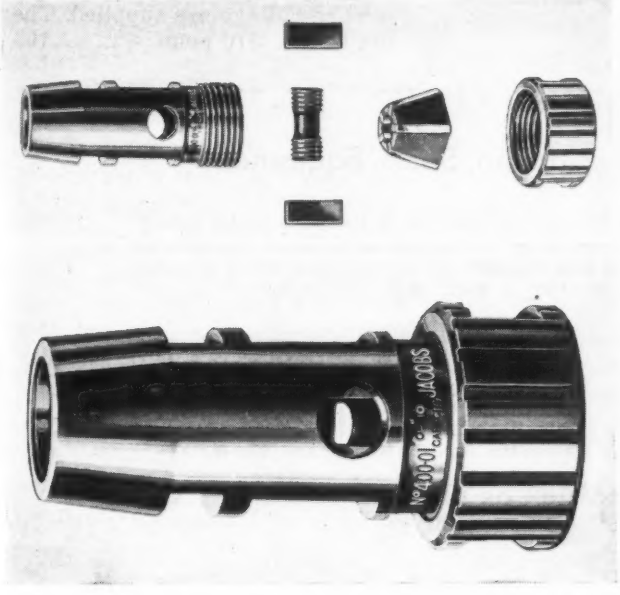
Kennametal Inc., Latrobe, Pa., has announced the development of a standard line of internal radius tools and blanks for rounding the corners of machine parts. These tools are form-ground to hold their contour when reground on the top surface only. This line of tools includes twelve of the most frequently required sizes with corner-forming radii ranging from 3/32 to 1/2 inch. Kennametal Grade K3H tools are recommended for machining corners on steel parts, and Grade K6 for cast-iron, brass, bronze, and light alloy parts. 102



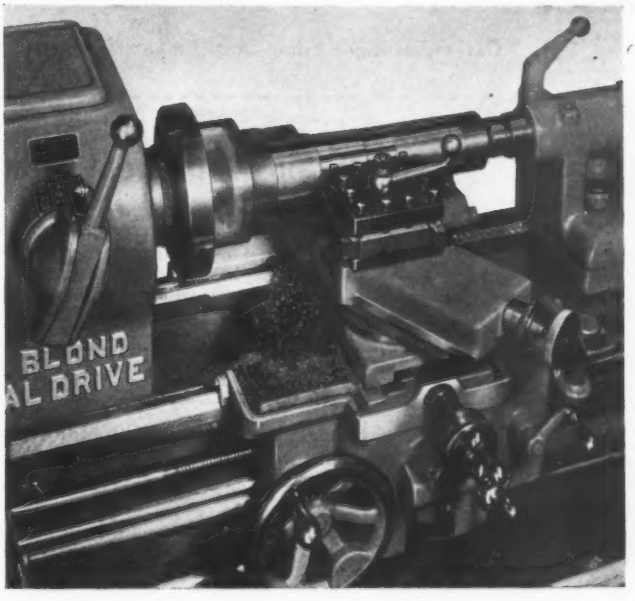
Kennametal Tool for Radius-forming Corners of Parts

Enco Toolpost Turret

A toolpost turret designed especially for use on the LeBlond dual-drive lathe has just been added to the line of toolpost and tailstock turrets and "Hexturrets" made by the Enco Mfg. Co., 4522 Fullerton Ave., Chicago, Ill. These turrets are designed to provide extremely rigid mountings for carbide-tipped tools that are supported by a flat base and clamped in place by at least three screws. They



Jacobs Small-Diameter Tap Chuck Shown Assembled and Disassembled



Toolpost Turret Designed by Enco Mfg. Co. for Carbide-tipped Tools

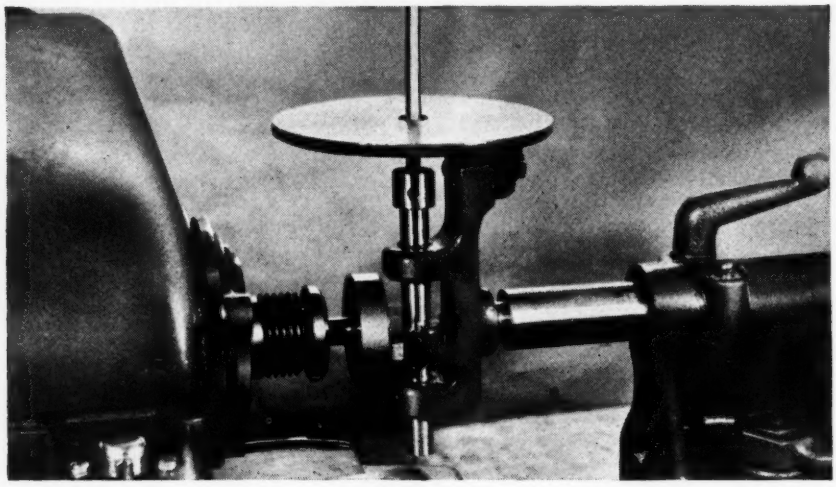
To obtain additional information on equipment described on this page, see lower part of page 218.

will accommodate tools of any size up to 5/8 by 1 inch.

A quick set-up for threading operations is made possible by this twelve-station, 30-degree indexing type turret. Three different working positions are available for each tool, and it is possible to use each tool for more than one operation. An equalizer spring serves to keep the toolblock and clamping lever in contact, eliminating chip interference and making indexing rapid and easy. 103

Filing Attachment for Lathe

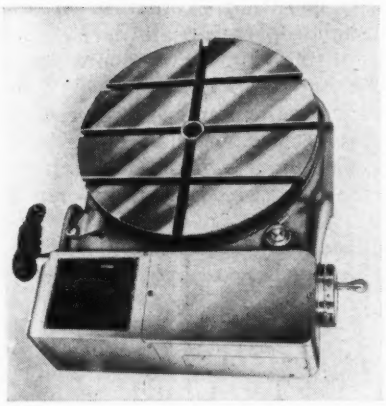
A compact filing attachment that can be applied to a lathe without using screws or clamps is being manufactured by the Carey-Anslinger Mfg. Co., 1129 E. Bourbonnais, Kankakee, Ill. The tapered arbor of the attachment is simply slipped into the tailstock spindle socket, and the driving shaft clamped in the three-jaw chuck or collet of the headstock spindle. The attachment is then ready for use in filing wood, metal, hard rubber, fiber, plastics, and similar materials. 104



Carey-Anslinger Filing Attachment Applied to Lathe

Knight Motor-Driven Rotary Table

A new rotary table designed to quickly adapt any milling machine, shaper, or horizontal boring mill for power rotary milling or precision indexing work has been announced by the W. B. Knight Machinery Co., St. Louis, Mo. This single-unit, electrically driven table has been developed to reduce set-up time to the minimum. No power connection to the machine on which it is used or extra equipment is required.



Knight Single-unit Motor-driven Rotary Table with Power Feed

Eighteen feed changes from 1 1/2 to 54 inches per minute are provided on the 20-inch diameter table. An optional feed range of 3 to 108 inches per minute is also available. Other features include a simplified system of changing feed-gears; graduations in minutes, as well as degrees; T-slots machined from the solid; and anti-friction bearings.

Standard equipment furnished with these tables includes three index-plates and crank, feed-change gears, hold-down clamps, stop-dogs, lifting clamps, and locating key to fit the machine table. Dimensions of the table are 24 3/4 inches wide, 30 inches long, and 7 1/4 inches high. Reversible electric motors of 1/4 H.P. for any specified voltage are supplied. The unit weighs 570 pounds. 105

To Obtain Additional Information on Shop Equipment

Which of the new or improved equipment described in this section is likely to prove advantageous in your shop? To obtain additional information or catalogues about such equipment, fill in below the identifying number found at the end of each description—or write directly to the manufacturer, mentioning machine as described in May, 1947, MACHINERY.

No.	No.	No.	No.	No.	No.	No.	No.	No.	No.

Fill in your name and address on blank below. Detach and mail within three months of the date of this issue to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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[This service is for those in charge of shop and engineering work in manufacturing plants.]

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CITY..... STATE.....

NEW! THE OZALID STREAMLINER

- Reproduces your engineering and architectural drawings in seconds—also your typed, printed, photographic material.
- Moderately priced . . . designed for the thousands of drafting rooms that want these 5 EXTRA VALUES in Printmaking at no extra cost—

1. EFFICIENCY! You always get positive (not negative) prints direct from your tracings . . . prints that are sharper, brighter, much easier for you to read, check, and make notations on.

You produce these without waste of material or waste of motion. Your tracings can be up to 42 inches wide, any length . . . and can be printed either on rolls of Ozalid sensitized paper or on cut sheets of matching size.

Your prints are always delivered dry, ready for immediate use . . . after just two simple operations—Exposure and Dry Development.

2. SPEED! ONLY 25 seconds to reproduce your standard-size tracings, specification and data sheets, etc.

3. ECONOMY! An 8½ x 11-inch reproduction costs you *one cent;* 11 x 17 inches, two cents . . . and so on. The Ozalid Streamliner soon pays for itself . . . in time, labor, and dollars saved.

With it, you can also effect amazing short cuts in design. For example—eliminate redrafting when changing obsolete drawings . . . combine the details of separate tracings on *one* print . . . re-

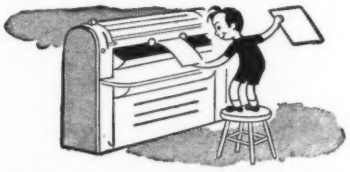
claim old or worn tracings . . . make transparent overlays in different colors.

4. VERSATILITY! You can reproduce the lines and images of any original in black, blue, red, sepia, or yellow . . . on paper, cloth, foil, film, or plastic.

Simply use the Ozalid sensitized material you think best for job at hand; e.g., use identifying colors for prints of separate departments or operations . . . DRYPHOTO to produce beautiful con-

tinuous-tone prints from film positives (which can be made from any negative) . . . OZAPLASTIC to produce oilproof, waterproof prints for shop or field use. *All* prints are made in same fast, economical manner.

5. SIMPLICITY! NOW—printmaking is an easy desk job, automatic in practically every detail.



Anyone can feed originals and sensitized material into the Ozalid Streamliner. Prints are delivered on top, stacked in order—within easy reach of the operator, who does not have to leave her chair.

You can install your Streamliner anywhere; it requires only 11 square feet of floor space.

Write today for free, illustrated booklet . . . showing all the ways you can use the new OZALID STREAMLINER . . . and containing actual reproductions — like those you can make.

Gentlemen: Dept. 265

Please send New Ozalid Streamliner booklet . . . containing reproductions of drawn, typed, printed, and photographic material. No obligation.

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New Trade Literature

RECENT PUBLICATIONS ON MACHINE SHOP EQUIPMENT, UNIT PARTS, AND MATERIALS

To Obtain Copies, Fill in on Form at Bottom of Page 222 the Identifying Number at End of Descriptive Paragraph, or Write Directly to Manufacturer, Mentioning Catalogue Described in the May, 1947, Number of MACHINERY

Cutting Oil

MACHINERY LUBRICANTS, INC., 31 St. James Ave., Boston 16, Mass. Pamphlet describing the application of "Silver-Chip," a synthetic non-petroleum cutting oil for machine tool lubrication. Copies are available from manufacturer if requested on company stationery.

Tracer-Controlled Milling Machine

PRATT & WHITNEY DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Catalogue covering the principles of operation, construction, and application of the Pratt & Whitney-Keller Type BL automatic tracer-controlled milling machine. 1

Drills and End-Mills

MORSE TWIST DRILL & MACHINE CO., New Bedford, Mass. Leaflet describing short standard drills for screw machines, portable electric drills, and automotive servicing jobs. Catalogue on single- and double-end "Hi-Helix" high-speed steel end-mills for heavy production. 2

Three-Way Broaching Machines

AMERICAN BROACH & MACHINE CO., Ann Arbor, Mich. Circular 100, illustrating and describing the American Type T three-way vertical hydraulic broaching machine, suitable for surface broaching and for push and pull internal operations. 3

Electronic Controls

WHEELCO INSTRUMENTS CO., 847 W. Harrison St., Chicago 7, Ill. Condensed catalogue 3-6400, showing all types of Wheelco electronic-control instruments, including measuring, positioning, and proportioning instruments, as well as thermometers, pyrometers, etc.....4

Recording and Controlling Instruments

BRISTOL CO., Waterbury 91, Conn. Bulletin W1811, listing over 150 different recording and controlling instruments available for immediate delivery including recording thermometers, pyrometers, pressure gages, voltmeters, ammeters, etc. 5

Special Machine Tools

BAKER BROTHERS, INC., Toledo 10, Ohio. Application bulletin 2-1947, describing special high-production machines for drilling, boring, tapping, contour grinding, and keyseating, as well as the Baker standard line of machine tools. 6

Electric Tools

BRADFORD MACHINE TOOL CO., 657 Evans St., Cincinnati 4, Ohio. Catalogue 50, containing complete descriptions, including specifications and horsepower ratings, of Metalmaster general-purpose portable and pedestal type electric tools and accessories. 7

Cemented-Carbide Tools

KENNAMETAL INC., Latrobe, Pa. Catalogue 47, giving complete specifications on Kennametal cemented-carbide products, including turning, facing, and boring tools, milling cutters, saw and router bits, and rolls for cold metal strip mills. 8

Refractories and Abrasives

NORTON CO., Worcester 6, Mass. Catalogue R-1-Q, containing technical information on Norton heavy-duty refractories. Circular 559-IP, containing data on Norbide abrasives for lapping, for cutting and polishing wire-drawing dies, and for lapidary work. 9

Drilling Machines for Special-Purpose Work

ROBBINS ENGINEERING CO., 318 Midland Ave., Detroit 3, Mich. Catalogue descriptive of the Robbins No. 3 Drillmatic, a standard unit adaptable for special-purpose drilling, reaming, tapping, and boring operations, performed individually or in multiple.....10

Blueprinting Machines and Accessories

C. F. PEASE CO., 2601 W. Irving Park Road, Chicago 18, Ill. General catalogue containing 238 pages of data on the company's line of blueprinting machines, white printing machines, sensitized papers, drafting-room furniture, etc.....11

Inspection and Sorting System

ARMA CORPORATION, 254 Thirty-sixth St., Brooklyn 32, N.Y. Folder describing the savings made possible in inspecting and sorting parts on production and assembly lines by the use of the "Limitron" inspection system. 12

Portable Drilling and Tapping Machines

KAUKAUNA MACHINE CORPORATION, Kaukauna, Wis. Catalogue illustrating and describing the Kaukauna Series 125 portable

horizontal drilling and tapping machines and Model 700 indexing table. 13

Vertical-Spindle Surface Grinders

HANCHETT MFG. CO., Big Rapids, Mich. Catalogue 847-1, describing new and improved surface grinding procedures with vertical-spindle surface grinders equipped with reciprocating tables. 14

Gear-Tooth Pointing and Chamfering Machines

CROSS CO., 3250 Bellevue Ave., Detroit 7, Mich. Booklet 60, illustrating and describing the Cross 60 series machines for pointing and chamfering spur, helical, and bevel gears, and splines. 15

Automatic Press Feeds

LA BAHN MACHINE & MFG. CO., Menlo Park, N. J. Catalogue illustrating and describing the principle of construction, method of operation, and application of La Bahn automatic roll feeds for punch presses. 16

Removal of Gases from Metals

AIR REDUCTION, 60 E. 42nd St., St., New York 17, N. Y. Booklet containing a reprint of an article entitled "Removal of Dissolved Gases from Molten Metals by Flushing."....17

Abrasive Disk Sanders

CLOVER MFG. CO., Norwalk, Conn. Technical bulletin 6, describing abrasive disk sanders of the stationary and portable types; also contains an article on "Method of Finishing Open-end Wrenches on the Polishing Lathe." 18

Molding Presses

BALDWIN LOCOMOTIVE WORKS, Philadelphia 42, Pa. Bulletin 251, descriptive of high-speed compression molding presses and high-speed universal plunger molding presses for molding plastics and soft rubber products. 19

Mechanical Finishing of Metal Parts

STURGIS PRODUCTS CO., Sturgis, Mich. Booklet describing the complete line of Roto-Finish machinery and equipment for mechanical finishing of metal stampings, die-castings, and other parts. 20

Electric Stud-Welding

NELSON SALES CORPORATION, Lorain, Ohio. 36-page pamphlet illustrating various applications of high-speed stud-welding, and describing types of electric stud-welding guns and standard and specialized flux-filled studs.....21

Corrosion-Resistant Process

PARKER RUST PROOF CO., 2177 E. Milwaukee, Detroit 11, Mich. 44-page catalogue descriptive of the bonderizing process and its application on steel, aluminum, and zinc as a corrosion-resistant base for paint finishes.....22

Hole-Punching Units

WALES - STRIPPIT CORPORATION, 345 Payne Ave., North Tonawanda, N. Y. Catalogue CD, illustrating the features of Wales Type CD hole-punching units for punching mild sheet metal up to ⅛ inch thick. 23

Combination Vise and Angle-Plate

GALE FORSSEN CO., 64 Monmouth St., Springfield 9, Mass. Circular illustrating and describing a new combination vise and angle-plate for precision work, known as the "Sta-Ga-Co."....24

Milling Machines

CINCINNATI MILLING MACHINE CO., Cincinnati 9, Ohio. Catalogue M-1507-1, giving specifications and design details covering Cincinnati general-purpose plain and universal milling machines.....25

Precision Surface Grinders

REID BROTHERS COMPANY, INC., Beverly, Mass Catalogue illustrating and describing Reid finger-tip control surface grinders with hand and automatic power feed, especially designed for high-precision work. 26

Precision Lathes

SOUTH BEND LATHE WORKS, 383 E. Madison St., South Bend 22, Ind. Catalogue 13-F, illustrating and describing the South Bend 13-inch swing quick-change gear and tool-room precision lathes...27

Arc-Welding Electrodes

ALLOY RODS CO., York, Pa. Bulletin 1-47, containing technical data and specifications on Weld-Arc electrodes for welding mild steels and low-alloy, high tensile-strength steels. 28

To Obtain Copies of New Trade Literature

listed in this section (without charge or obligation) fill in below the publications wanted using the identifying number at the end of each descriptive paragraph; detach and mail within three months of the date of this issue (May, 1947) to MACHINERY, 148 Lafayette Street, New York 13, N. Y.

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Carboloy-Tipped Cutting Tools

NELCO TOOL CO., INC., 370 Hamilton Ave., Brooklyn 31, N. Y. Catalogue illustrating and describing the complete line of Carboloy-tipped cutting tools made by this company. Data on resharpening and maintenance is included.....29

Carbide-Tipped Cutting Tools

SUPER TOOL CO., 21650 Hoover Road, Detroit 13, Mich. Catalogue 47, describing this company's line of carbide-tipped cutting tools for a wide variety of applications. Included is a description of a new ejector type tool bit. 30

Electrolimit Height Gage

PRATT & WHITNEY, DIVISION NILES-BEMENT-POND CO., West Hartford 1, Conn. Circular 486, descriptive of the P & W Electrolimit height gage and its application.....31

Electronic Tube Data

WESTINGHOUSE ELECTRIC CORPORATION, P. O. Box 868, Pittsburgh, Pa. Booklet 86-020, listing electronic tubes according to their class and giving all essential technical data on each tube.....32

Tool and Cutter Grinders

OLIVER INSTRUMENT CO., 1410 E. Maumee St., Adrian, Mich. Bulletin descriptive of the standard "Ace" tool and cutter grinder and a heavy-duty precision grinder for carbide-tipped tools. 33

Uses of Steel

JOSEPH T. RYERSON & SON, INC., Chicago 80, Ill., is distributing a pictorial rotogravure circular illustrating a variety of uses of steel by a series of unusual action type photographs. 34

Deburring and Finishing Abrasive

MINNESOTA MINING & MFG. CO., St. Paul 6, Minn. Catalogue containing data on the use of Honite abrasive pebbles for low-cost deburring and finishing. 35

Power Tools

ARISTO POWER TOOLS, INC., 601 W. Washington Blvd., Chicago 6, Ill. Catalogue containing thirty-two pages covering new developments in power tools, including drills, buffers, polishers, etc.....36

Drilling Machines

SIBLEY MACHINE & FOUNDRY CORPORATION, 206 E. Tutt St., South Bend 23, Ind. Folder illustrating and describing Sibley 24- and 28-inch drilling machines and accessories.....37

Hydraulic Clamping Unit

JOHN S. BARNES CORPORATION, 147 Walnut St., Rockford, Ill. Bulletin 305-U, illustrating and describing a new hydraulic clamping unit known as the "Rapidraulic Jr."....38

Self-Propelled Arc-Welder

HOBART BROTHERS CO., Troy. Ohio. Circular illustrating and describing the "Weldmobile," a self-propelled gasoline engine driven arc-welder for railway maintenance and repair. 39

Internal and External Threading Tool

DORMAN MACHINE TOOL WORKS, Mount Vernon, N. Y. Leaflet describing a new tapping tool that can be used for both internal and external threading. 40

Chain Belts

CHAIN BELT CO., 1600 W. Bruce St., Milwaukee 4, Wis. Bulletin 46-10, on Rex steel fabricated and cast chain belts for transmission of power and conveying of material. 41

Electric Impact Wrenches

INGERSOLL-RAND CO., 11 Broadway, New York 4, N. Y. Circular 5011, containing data on the Ingersoll-Rand impact wrench with high-cycle motor. 42

Centerless Belt Grinder

PORTER-CABLE MACHINE CO., Syracuse 8, N. Y. Circular giving design details and specifications of the Porter-Cable L-4 wet- or dry-belt centerless grinder. 43

V-Belt Drives

ALLIS-CHALMERS MFG. CO., Milwaukee, Wis. Catalogue containing 144 pages of engineering information on Texrope drives for applications from 1 to 150 H.P...44

Design and Research Service

DESIGNERS FOR INDUSTRY, INC., 2915 Detroit Ave., Cleveland 13, Ohio. Booklet entitled "D F I Planned Products Service." 45

Bench Machine Tools

BENCHMASTER MFG. CO., 2952 W. Pico Blvd., Los Angeles 6, Calif. Bulletin illustrating and describing bench machine tools, including punch presses, milling machines, and accessories. 46

Heat-Treating Fixtures

DRIVER-HARRIS CO., Harrison, N. J. Bulletin F-46, describing and illustrating specially designed heat-treating fixtures for pit type furnaces.....47

Hydraulic Lift-Trucks

TRUCK-MAN, INC., 1426 Ganson St., Jackson, Mich. Folder containing specifications on the Model D Truck-Man, a gasoline-powered hydraulic lift-truck. 48

Press Feeds

H. E. DICKERMAN MFG. CO., 321 Albany St., Springfield, Mass. Catalogues descriptive of Dickerman die feeds and hitch feeds for punch presses. 49

Cutting Oil

D. A. STUART OIL CO., LTD., 2739 S. Troy St., Chicago 23, Ill. Folder describing "KleenKut"—a water-mix cutting oil—and its applications. 50

Electric Chain Hoists

WHITING CORPORATION, Harvey, Ill. Bulletin H-100-A, describing a new line of electric chain hoists of one-quarter, one-half, and one-ton capacities. 51

Airless Blast Cleaning

PANGBORN CORPORATION, Hagerstown, Md. Bulletin 214, covering Rotoblast airless blast cleaning methods and equipment. 52

Expanding Mandrels

K. O. LEE CO., Aberdeen, S. D. Leaflet describing "Knock-Out" expanding mandrels for turning, grinding, and milling jobs.....53

Multiple-Unit Furnaces

HEVI DUTY ELECTRIC CO., Milwaukee 1, Wis. Bulletin HD 1246, descriptive of multiple-unit crucible furnaces. 54

Motorized Lift-Trucks

READY-POWER CO., Detroit, Mich. Bulletin 114, descriptive of a new gas-electric drive for motorized lift-trucks.....55

"Phillips Screws best suited to new assembly techniques" . . .

says

GLOBE AMERICAN CORP.

Highlights of an interesting report by the independent investigator of the James O. Peck Co. . . . another in their series of studies of assembly savings made with Phillips Recessed Head Screws.

"We are 100% sold on Phillips Screws," the Works Manager of Globe American said, "because they fit right into our plans for the most efficient production methods in manufacturing our Dutch Oven Gas Ranges.

"Easier To Power-Drive. The Phillips Recessed Head is perfect for the air tools we're using in our assembly. They're practically *geared* to the tool so they start faster and drive easier.

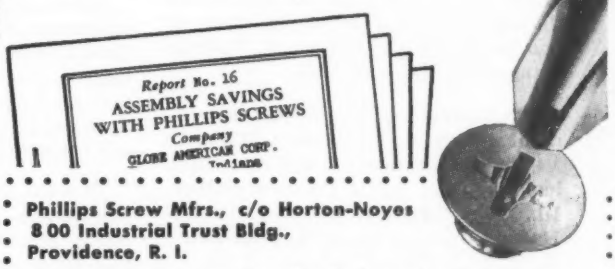
"Simplify Awkward Applications. In the sub-assemblies and the final assembly many of the Phillips Screws used in each stove have to be driven from an angle . . . putting on door handles, driving under a ridge and some 'blind' driving. Most of these applications would be difficult or impossible with slotted screws, but are simple with Phillips Screws because of the snug fit of driver bit in the recess. Even when the driver is at an angle, they can be set up tight.

"No Gouging of Enamel. A lot of these screws are used close to the enamel finish of the stove. A regular slotted head driver would jump out of the screw head and scratch the work often enough to make the cost of consequent disassembly, refinishing and reassembly a serious factor. This can't happen with Phillips Screws."

One of the many sub-assemblies of the Dutch Oven Ranges which illustrates the hazards to enamel finishes if slotted screws were used.

Straight-on or angled, the Phillips Recessed Head permits a fast start and a safe finish.

You'll Find Good Ideas for your assembly in this and other reports of assembly studies . . . covering metal, wood and plastic products. Use coupon.



PHILLIPS *Recessed Head* SCREWS

Wood Screws • Machine Screws • Self-tapping Screws • Stove Bolts

23 SOURCES

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National Screw & Mfg. Co.
New England Screw Co.
Parker-Kalon Corporation
Pawtucket Screw Co.
Pheoll Manufacturing Co.
Reading Screw Co.
Russell Burdsall & Ward Bolt & Nut Co.
Scovill Manufacturing Co.
Shakeproof Inc.
The Southington Hardware Mfg. Co.
The Steel Company of Canada, Ltd.
Sterling Bolt Co.
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News of the Industry

Florida and Louisiana

A. D. ROBERTSON, formerly assistant manager of sales and engineering of the electrical section at the Norwood, Ohio, works of the Allis-Chalmers Mfg. Co., has been named manager of the company's Tampa, Fla., district office, succeeding the late Berrien Moore.

JOSEPH C. TOURNE, of the General Engineering & Equipment Corporation, 618 Carondelet Building, New Orleans, La., has been appointed southern regional manager for Hydro-Power, Inc., Springfield, Ohio.

Illinois

LINDBERG ENGINEERING CO., manufacturer of heat-treating furnaces and electrical equipment, and the FISHER FURNACE CO., manufacturer of non-ferrous melting furnaces, refractories, and blowers, have recently united their organizations. The Fisher organization will hereafter be known as the Fisher Furnace Division of the Lindberg Engineering Co., and will be headed by KENNETH D. HOKE, formerly vice-president of the Fisher Furnace Co. Fisher furnace manufacturing will be carried on at the main Lindberg office and plant at 2444 W. Hubbard St., Chicago, Ill., while refractories will continue to be manufactured at 5535 N. Wolcott St., Chicago.

OWEN B. OLSON has been appointed a sales engineer in the Chicago district for the Hyatt Bearings Division, General Motors Corporation, Harrison, N. J. Prior to joining Hyatt, Mr. Olson served in the production engineering department of Wallace & Tiernan Co.

INDEPENDENT PNEUMATIC TOOL CO., 600 W. Jackson Blvd., Chicago, Ill., manufacturer of Thor portable pneumatic and electric tools, has announced the opening of a technical office at Sao Paulo, Brazil. Reuben P. Rudy is manager of the new office.

TAYLOR-HALL WELDING CORPORATION, a subsidiary of the FEDERAL MACHINE AND WELDER COMPANY, Warren, Ohio, has given the DOALL CO., Des Plaines, Ill., the exclusive right to sell Taylor-Hall products in the export market.

ELMER SCHNEIDER has been elected vice-president and director of engineering of Wheelco Instruments Co., Chicago, Ill. JOSEPH A. REINHARDT will become plant manager.

ROLLWAY BEARING CO., INC., announces that the Chicago office of the company has been moved to new quarters at Room 3716 Civic Opera Bldg., 20 N. Wacker Drive, Chicago, Ill.

E. A. RUGGLES has been appointed general manager of the Spring Division of the F. L. Jacobs Co. at Danville, Ill.

Michigan

SHARON STEEL CORPORATION, Sharon, Pa., has announced the establishment of the DETROIT TUBE & STEEL CO., formed by the merger of the DETROIT SEAMLESS STEEL TUBES CO. and the BOPP STEEL CORPORATION. The new firm will function as a wholly-owned Sharon subsidiary.

A. N. GODDARD, founder of Goddard & Goddard Co., Detroit, Mich., recently retired as president of the company, but will continue his activities as chairman of the board. E. A. GODDARD, former vice-president and general manager, has been elected president and general manager. L. H. GODDARD has been elected vice-president, and in addition to his new duties, will continue his activities in the sales field.

LEMAIRE TOOL & MFG. CO., Dearborn, Mich., has acquired the patents and manufacturing rights covering the Sundstrand three-wheel grinder formerly built by the Sundstrand Machine Tool Co., of Rockford, Ill. The new owner will service any of these grinders now in the field.

ARTHUR A. ATWELL has been elected a director and senior vice-president of the U. S. Broach Co., 6463 E. Seven Mile Road, Detroit 12, Mich., and E. H. H. GRAF has been elected vice-president in charge of sales and engineering.

ROBERT C. ENOS has been elected chairman of the board of the E. W. Bliss Co., Detroit, Mich. Mr. Enos has been a director since 1945. FRANKLIN L. BERWIN has been elected a director to fill the vacancy caused by the resignation of D. S. HARDER.

HOWARD A. HEIN, formerly chief sales engineer for the Cleveland Automatic Machine Co., Cleveland, Ohio, has been appointed manager of the Detroit branch office at 540 New Center Bldg.

CARBOLOY COMPANY, INC., Detroit, Mich., announces the appointment of the following distributors: VONNEGUT HARDWARE CO., 402 W. Maryland, Indianapolis, Ind., and YOUNG & VANN SUPPLY CO., 1731 First Ave., Birmingham 2, Ala.

New England

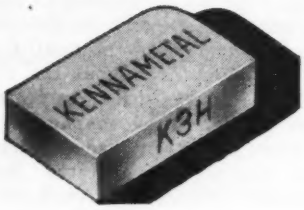
COLONEL HOWARD W. ROBBINS has retired from the position of safety engineer with the Norton Co., Worcester, Mass., after thirty-one years of service. He has been succeeded by JOHN HYCHKA of the engineering department. JOHN R. H. TRUELSEN has been appointed abrasive engineer for the Milwaukee, Wis., area. RICHARD H. MERCHANT is now field engineer in the Detroit district.

MORSE TWIST DRILL & MACHINE CO., New Bedford, Mass., at the annual meeting of stockholders, amended the by-laws to increase its board of directors to nine. The following directors were elected: J. Y. SCOTT, L. F. HUNDERUP, J. A. WRIGHT, E. C. ADAMS, W. T. READ, R. W. PORTER, L. H. STANTON, M. J. RAINEY, and A. J. SNYDER.

E. HALSEY BRISTER has been appointed sales manager of the Bay State Abrasive Products Co., Westboro, Mass., succeeding the late Arthur G. Green. Mr. Brister has been associated with the organization since 1944, acting in the capacity of quality control manager. Previously he was associated for thirteen years with the Norton Co.

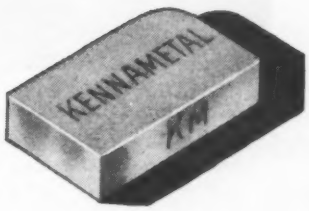
E. Halsey Brister, New Sales Manager, Bay State Abrasive Products Co.

IT PAYS TO KNOW *Your* KENNAMETAL *GRADES!*



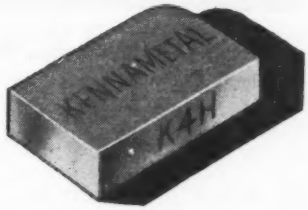
Most crater-resistant Kennametal tool material—gives outstanding service for finishing or moderate cuts on carbon and alloy steels .30% carbon and higher. Also time-and money-saver for general use on soft steels containing less than .30% carbon, precision boring of steel where .004" feed or over is used, and for many milling jobs on steel. 92 Rockwell A hardness.

The hardest Kennametal tool material grade — specifically for solid tools used on precision boring of steel parts. Its high hardness, great resistance to cratering, and unusual strength can help you cut costs where fast, accurate work is essential. 93.2 Rockwell A hardness.



Strongest crater-resistant Kennametal tool material—saves tooling and production costs when taking rough cuts on carbon and alloy steel forgings, bar stock, etc., having carbon content of .30% and higher. Also outstanding for milling of steel at heavy chip loads. 91 Rockwell A hardness.

A very strong Kennametal tool material, particularly suitable for roughing cuts on steel castings. Its high resistance to abrasion and edge wear of sand inclusions makes possible exceptionally high rate production, and economical tooling costs. 91.5 Rockwell A hardness.



Highly resistant to edge wear—takes a good edge—a money-saving tool material for very light finishing cuts on steel and for precision boring with less than .004" feed. Ideally suited for tools requiring large nose radius or where tool must dwell without cutting. Excellent for milling, and very rough cutting of brass, bronze, and aluminum alloys. 92.3 Rockwell A hardness.

Reduces cost of machining cast iron. Extremely hard, straight tungsten carbide tool material having unusual strength. Holds keen edge, withstanding shock of interrupted cuts on rough, sandy, or chilled castings. Also outstanding for finishing and precision boring of cast iron. 92.2 Rockwell A hardness.

KENNAMETAL Blanks are now sold in *Economical* "Package Lots."
For Prices and Particulars Send for Catalog 46

TRADE MARK REG U. S. PAT. OFF.

KENNAMETAL

SUPERIOR CEMENTED CARBIDES

KENNAMETAL *Inc.*, LATROBE, PA.

W. J. Eberlein, Vice-president in Charge of Sales of Greenfield Tap & Die Corporation

W. J. EBERLEIN, general sales manager of Greenfield Tap & Die Corporation, Greenfield, Mass., has been elected vice-president in charge of sales. He has been connected with the corporation for over thirty years.

REED-PRENTICE CORPORATION, Worcester, Mass., has announced the election of FREDERICK W. MCINTYRE, JR., and CHARLES H. CARSWELL to the board of directors. Mr. McIntyre is vice-president of the company, and Mr. Carswell is treasurer of the Universal Winding Machine Co., Providence, R. I.

KENNAMETAL INC., Latrobe, Pa., has appointed LAWRENCE W. GUILD as manager of a new district — the New England district — comprising territories covered by the Hartford, Springfield, and Boston offices. His headquarters will be at 1537 Main St., Springfield, Mass.

ARTHUR E. KALLINICH and DAVID J. POST have been elected vice-presidents of VEEDER-ROOT, INC., Hartford, Conn., and ANDREW J. REBMANN has been elected assistant treasurer. Mr. Kallinich joined the company in 1912, and became sales manager in 1944. Mr. Post became associated with the company in 1926, and was made assistant sales manager in 1928. In 1944 he was appointed assistant to the president.

EASTERN INDUSTRIES, INC., New Haven, Conn., has purchased the buildings, machinery, and product production rights of the MCINTYRE Co., Newton, Mass. As the McIntyre Division of Eastern Industries, Inc., the newly acquired facilities will continue to manufacture the line of pumps and fluid motors that it has in the past.

FEDERAL PRODUCTS CORPORATION, Providence, R. I., has completed the addition of a three-story extension and a third floor to its main plant.

RICHARD F. V. STANTON was recently elected vice-president of the Pratt & Whitney Division Niles-Bement-Pond Co., West Hartford 1, Conn. He will also continue to serve in his capacity as assistant machine tool sales manager. Mr. Stanton has been connected with Pratt & Whitney for thirty years, starting as supervisor of gage design in the ammunition equipment engineering department. During the period of the war, he held the post of manager of the contract division,

Richard F. V. Stanton, Newly Elected Vice-president of Pratt & Whitney

and served for a year on the War Production Board in Washington as a machine tool consultant.

New Jersey

PAUL H. HOLTON has been appointed manager of the Atlantic district office of Carboloy Company, Inc., at 1060 Broad St., Newark, N. J. Mr. Holton, who has been a sales engineer in the Philadelphia area for the Carboloy Company since 1937, succeeds T. D. MACLAFFERTY, who resigned March 1. PAUL SCHICK will succeed Mr. Holton at the Philadelphia branch.

DR. MELVILLE F. PETERS, formerly in charge of research at Titeflex, Inc., Newark, N. J., manufacturer of flexible metal hose and industrial filters, has been appointed chief engineer.

New York

H. K. CLARK, formerly executive vice-president of the Carborundum Co., Niagara Falls, N. Y., was elected president of the company at a recent meeting of the board of directors, succeeding ARTHUR BATTS, who was elected chairman of the board. EDWIN R. BRODEN was elected vice-president in charge of operations, as well as a member of the board of directors and a member of the executive committee. Among other changes announced is the retirement of OTIS HUTCHINS as technical director. Mr. Hutchins is retiring because of ill health after thirty-five years of service with the company. He will be succeeded by HARRY C. MARTIN, previously assistant technical director. Another new appointment is, that of EDWARD R. NEWCOMB as director of sales engineering of the Coated Abrasive Division throughout the United States. He was previously one of three regional sales managers. BOYD H. WORK has been made director of sales engineering for the Bonded Abrasive Division throughout the United States and Canada. S. S. DIEMER has been promoted from the position of purchasing agent to that of manager of purchases, and RICHARD KIMBALL has been made assistant manager of purchasing. WILLIAM E. BLAKE, formerly assistant to Mr. Diemer, assumes the title of purchasing agent. In the Technical Division, GEORGE J. EASTER, formerly director of research, has been made manager of research and development, and FRED A. UPPER has been advanced to the post of manager of manufacturing technical service.

WALDEMAR NAUJOKS has been elected president of the Bison Forge Co., Inc., 115 Manitoba St., Buffalo, N. Y., where he will be associated as partner with DAVID L. GEORGE. Mr. Naujoks was

Waldemar Naujoks, President of the Bison Forge Co.

GEAR HIGHLIGHTS

VOL. XI NO. 2

This is page 1 of the current issue. Write for the complete issue today.

ALSO IN THIS ISSUE

STANDARDIZED CONE-DRIVE SPEED REDUCERS NOW AVAILABLE

A complete standardized line of speed reducers, built around double enveloping Cone-Drive gearing is now in quantity production at the Cone-Drive plant of Michigan Tool Company in models to suit practically every requirement. The horsepower and torque these units will transmit for a given size is quite startling to anyone not familiar with Cone-Drive gearing.

The new standardized line includes models with pinion under, pinion over, and with gear shaft vertical. The center distances of from 2 to 18 inches cover a power-transmission range equivalent to 3″ to 24″ center distance in worm

(Continued on page 3)

UNDERPASS CURVE-SHAVING *Features* WISCONSIN AXLE'S PRODUCTION OF LARGE GEARS TO HIGH PRECISION

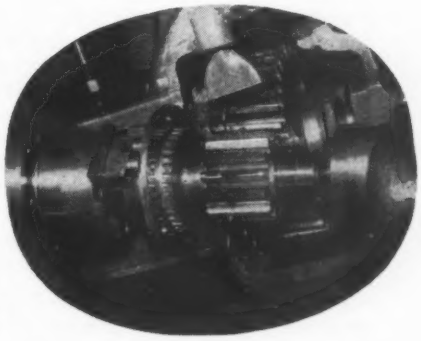
by PERRY L. ADAMS, Gear Superintendent
Wisconsin Axle Division—Timken-Detroit Axle Co.

Since the introduction of shaving into the gear manufacturing cycle, including the curve-shaving of pinions—and particularly since the Underpass method of shaving has been adopted, Wisconsin Axle Division of Timken-Detroit Axle Company, Oshkosh, Wisconsin, has not only been able to reduce manufacturing time and costs but has also been able to improve gear quality. Among the benefits reported are:

1. Less variation in involute form
2. More accurate tooth spacing
3. Correction of lead errors
4. More desirable mating contact between gears
5. Production output increase

These improvements result in corresponding improvements in the service life and quietness of the heavy duty gears which Wis-

(Continued on page 2)



MICHIGAN "SINE-LINE" LEAD —COMPARATORS—

Known as models 1200 and 1200A, virtually foolproof Michigan lead comparators are available for use on the production floor alongside gear cutting and shaving machines. The master multiple thread lead, followers, indicators and actuating mechanisms are all enclosed.

Machines may be used as an aid in setting up gear cutting and finishing machines, to check gears after processing, to determine lead compensation for "unwinding" of gears during heat-treat, etc.

They are applicable to both external and internal gears as well as worms. To change the machine over for checking gears of differ-

(Continued on page 4)

formerly chief engineer of the Steel Improvement & Forge Co., Cleveland, Ohio.

BOYE & EMMES MACHINE TOOL CO., Cincinnati, Ohio, has appointed the RUDEL MACHINERY CO., INC., 100 E. 42nd St., New York 17, dealer in the New York and Hartford territories.

AL-FIN CORPORATION, a subsidiary of the FAIRCHILD ENGINE AND AIRPLANE CORPORATION, has moved its offices and foundry to Farmingdale, Long Island.

FREDERICK E. MUNSCHAUER, JR., has been appointed works manager of the Niagara Machine & Tool Works, Buffalo 11, N. Y., manufacturer of presses,

Frederick E. Munschauer, Jr., New Works Manager of the Niagara Machine & Tool Works

shears, and sheet-metal working machines. Since the early part of 1946, when he was released from the armed services, he has been acting works manager.

Ohio

SHEFFIELD CORPORATION, Dayton, Ohio, has made arrangements to purchase control of the MURCHEY MACHINE & TOOL CO., Detroit, Mich., manufacturer of machine tools, threading tools, thread chasers, die-heads, and collapsible taps. Active management of the business will be under the direction of O. A. AHLERS, general sales manager, and ALBERT F. POLK, vice-president of the Sheffield Corporation. This addition to the Sheffield products will give the company a complete line of screw thread production equipment.

DONALD M. PATTISON, general sales manager of the Warner & Swasey Co., Cleveland, Ohio, was elected a member of the board of directors at the

Donald M. Pattison, Recently Appointed Vice-president in Charge of Sales, Warner & Swasey Co.

company's annual meeting of stockholders. He was also made vice-president in charge of sales. Mr. Pattison has been connected with the sales staff of the organization since 1929.

GEORGE C. FLOYD has been appointed manager of operations of the Thomas Steel Co., Warren, Ohio. Mr. Floyd succeeds HERMAN A. MENTALL, vice-president in charge of operations, who has retired after twenty years of service.

WENDELL E. WHIPP, president of the Monarch Machine Tool Co., Sidney, Ohio, since 1931, was elected chairman of the board at a recent meeting of the directors. JEROME A. RATERMAN, formerly executive vice-president, was made president. As chairman of the board, Mr. Whipp succeeds F. P. Thedieck, who died in January.

E. A. SCHIELE, 1747 McCormick Bldg., Chicago, Ill., and HENRY RONALD VOELKER, 118 E. 63rd St., Indianapolis, Ind., have been appointed representatives of the Steel Improvement & Forge Co., Cleveland, Ohio.

ROY V. THOMAS has been appointed personnel manager of the Ohio Crankshaft Co., Cleveland, Ohio.

Pennsylvania

EDWARD W. LAFFERTY has been placed in charge of sales in the Philadelphia-Washington area for the Cosa Corporation, representative in the United States for many Swiss high-precision machine tool manufacturers. Mr. Lafferty has been connected for many years with the machine tool industry.

C. R. HARMON has been appointed Pittsburgh district sales manager for the Firth Sterling Steel & Carbide Corporation, McKeesport, Pa. Until recently, Mr. Harmon was sales manager for Penn Carbide & Alloy Casting Co.

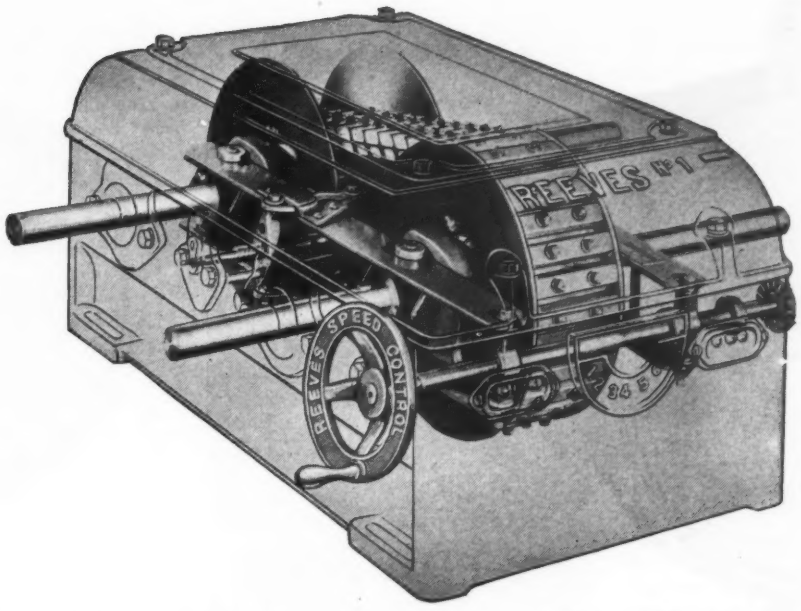
A. J. FISCHER has been appointed manager of the Carbide and Cast Alloy Division of the Jessop Steel Co., Washington, Pa. Mr. Fischer has been associated with the carbide industry for the last twelve years.

C. N. KIRKPATRICK has been elected chairman of the board of the Landis Machine Co., Waynesboro, Pa., and J. H. ELLIOTT has been elected president and general manager. R. G. MUMMA has been appointed secretary.

Moffett Studio

Moffett Studio

Wendell E. Whipp (Left) Chairman of the Board, and Jerome A. Raterman (Right) President of the Monarch Machine Tool Co.



Industry's Approved Method of Accurate, Variable Speed Control

The "missionary" work for variable speed control has been done. On every hand, in every industry where operating conditions are subject to change, there is abundant evidence to support its claims for increased output, improved, uniform quality and reduced cost.

Your problem, then, is one of selection . . . of determining which type and make of variable speed drive is best for your particular need. In making that choice, consider these facts about infinite, stepless REEVES Speed Control:

Manufactured by a company with more than fifty years' specialized experience in this specialized field. Design based on a proved operating principle. Ruggedly constructed for trouble-free operation and easy maintenance without special training or tools. Offered in a complete range of sizes, capacities and speed ratios, and furnished with any type of control . . . easily incorporated in new machine designs or applied to existing machines. Performance-proved in 260,000 installations and provided as standard equipment in 2,100 different makes of machines. Backed by a nation-wide engineering and service organization.

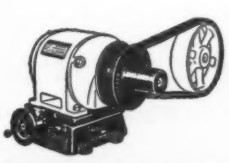
Think it over . . . this broad background of experience, this documented evidence of efficiency on any and all jobs . . . and we believe you will understand why REEVES is Industry's approved—*and proved*—method of variable speed control.

REEVES PULLEY COMPANY • COLUMBUS, INDIANA

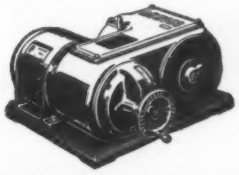
Recognized Leader in the Specialized Field of Speed Control Engineering

THE THREE BASIC REEVES SPEED CONTROL UNITS

VARIABLE SPEED TRANSMISSION for providing infinite, accurate speed flexibility over a wide range—2:1 to 16:1. Sizes—fractional to 87 hp.



VARI-SPEED MOTOR PULLEY converts any standard constant speed motor to a variable speed drive within 4:1 ratio. Sizes to 15 hp.



MOTODRIVE combines motor, speed varying mechanism and reduction gears in single compact unit. Speed variations 2:1 to 6:1 inclusive. Sizes to 15 hp.

Accurate Variable

REEVES Speed Control

Gives the Right Speed for Every Job!

SAMUEL R. RHOADS has been appointed manager of the Hydraulic Machinery Division of the R. D. Wood Co., Philadelphia, Pa. Mr. Rhoads previously held the post of chief designing engineer in charge of hydraulic machinery and hydraulic valve design.

E. W. HEFFERNAN has been appointed manager of the sales and service office at 424 W. Olney Ave., Philadelphia 20, Pa., of the Wheelco Instruments Co., Chicago, Ill.

JOSEPH W. HARVEY has been appointed general sales manager of the Vulcan Mold & Iron Co., Latrobe, Pa. Mr. Harvey has been with the sales department since 1924.

ROLLWAY BEARING CO., INC., Syracuse, N. Y., has opened a new sales office in Room 507, Renshaw Bldg., Pittsburgh, Pa., with JOHN B. BELL in charge.

Washington, Colorado, and Oklahoma

ALLEN W. JACOBSON, formerly manager of the experimental shops of the Boeing Aircraft Co., Seattle, Wash., has been appointed factory general superintendent, succeeding C. M. WEAVER, who has resigned. Mr. Jacobson's duties in the experimental division will be assumed by FRED P. LAUDAN, vice-president in charge of experimental manufacturing.

PAUL R. SPENCER & CO., 4000 York St., Denver, Colo., have been appointed sales agents for the Titan Metal Mfg. Co., Bellefonte, Pa., manufacturer of brass and bronze products, including forgings, die-castings, rods, and welding rods.

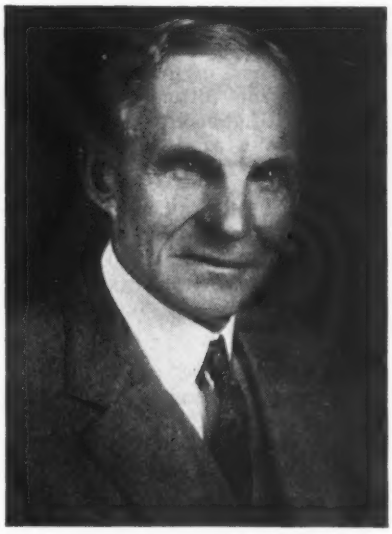
TITAN METAL MFG. CO., Bellefonte, Pa., announces the removal of the Tulsa, Okla., office from 310 Thompson Bldg. to 1348 S. Indianapolis St., Tulsa 4.

Wisconsin

KEN O. HOOD has recently been appointed Pacific Coast district manager for the Falk Corporation, Milwaukee, Wis., with headquarters in Los Angeles, Calif. He previously served as manager of the Cincinnati district. KENNETH W. MORRISSEY returns to the Cincinnati post after spending four years on a special war assignment at the home office.

L. E. MEIDINGER CO., INC., 606 W. Wisconsin Ave., Milwaukee 3, Wis., representative in the state of Wisconsin for the JESSOP STEEL CO., Washington, Pa., has changed its firm name to BELL STEEL SALES.

Obituaries



Henry Ford

On April 7, at the age of eighty-three, Henry Ford passed away. This great industrialist symbolized the opportunities offered by the country in which he lived. In a little over forty years, he guided the growth of the Ford empire from a small assembly shop having outstanding capital stock of $100,000 to a gigantic privately owned company whose value was almost beyond calculation and whose influence on the welfare of America was inestimable. His ideas on manufacturing and fabrication methods, and particularly of their dependence on the efficient handling of materials, revolutionized industry, reduced prices of consumer goods, raised the wages of labor, and carried the living standard of the nation to new heights. He was both the originator and champion of modern mass production techniques. As Ford and the automotive industry grew, so did the concerns that supplied them with raw materials and parts, machine tools and welding machines, and all the other durable goods required to keep America rolling.

When the Ford Motor Company started production of cars back in 1903, Henry Ford was nearly forty years of age. He had already spent fourteen years experimenting with internal combustion engines, first at night after working during the day in a Detroit machine shop, then while with the Detroit Edison Illuminating Co., and finally as chief engineer of the Detroit Automobile Co. Although capitalization of the new company was listed at $100,000, only $28,000 was in cash, part of the stock being given to John and Horace Dodge as compensation for tooling their machine shop to produce engines, and part to a carpenter named Stradlow for a small assembly shop. But with this modest investment, Ford turned out 1708 cars in the first year. Six years later, he was producing 100 cars per day and was offering a new Model T for approximately $350.

In 1911, as a result of his conviction that time spent in handling parts and assemblies was, in reality, time lost on non-productive operations, he installed an endless floor conveyor and chain. From that point on, the future of the company was virtually assured.

In 1919, he retired as president, leaving the active direction of the business to his son Edsel. When his son died in 1943, he stepped from retirement to again take command of company affairs at a time when the Allies were urgently in need of the quantity production he knew so well. Again in 1945 he retired, leaving the company in the hands of his grandson, Henry Ford II.

Charles F. Goedke

Charles F. Goedke, president of the Ganschow Gear Co. and the Fulton Machine Co., Chicago, Ill., died on February 20 at the Wesley Memorial Hospital, in Chicago, aged seventy-seven years. Mr. Goedke had been active in the American Gear Manufacturers Association for a number of years, having held the positions at various times of treasurer, vice-president, and president. He was also a

Charles F. Goedke

past-president and charter member of the S. and F. Club, National Metal Trades Association. He is survived by his wife and two daughters.

EARL H. WHEELER, a well-known mechanical engineer and screw machine expert of Simsbury, Conn., died suddenly on March 4 at the age of

fifty-six years. He was born in Dayton, Ohio, on August 27, 1890, and went to Simsbury, Conn. to live in 1943. Prior to that he had lived for several years at New Britain, Conn. Mr. Wheeler was for many years connected with the old Gridley Machine Co., Windsor, Vt., and in later years was an officer of the New Britain Gridley Machine Co. At the time of his death he was a partner of the Poly Choke Machine Co., Tariffville, Conn.

Coming Events

MAY 5-11—NATIONAL PLASTICS EXPOSITION at the Coliseum, Chicago, Ill., under the auspices of the Society of the Plastics Industry, Inc., 295 Madison Ave., New York 17, N. Y.

MAY 15-17—Annual meeting of the SOCIETY FOR EXPERIMENTAL STRESS ANALYSIS, including a Symposium on Shock and Impact, at the Stevens Hotel in Chicago, Ill. Further information can be obtained from the Society, P. O. Box 168, Cambridge 39, Mass.

MAY 26-29 — Meeting of the Aviation Division of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Los Angeles, Calif. Secretary, Clarence E. Davies, 29 W. 39th St., New York City.

JUNE 1-6—Summer meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the French Lick Springs Hotel, French Lick, Ind. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

JUNE 2-4—Thirty-first annual meeting of the AMERICAN GEAR MANUFACTURERS ASSOCIATION at Hot Springs, Va. Newbold C. Goin, executive secretary, Empire Bldg., Pittsburgh 22, Pa.

JUNE 16-19 — Semi-annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Stevens Hotel, Chicago, Ill. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

JUNE 16-20—Annual meeting of the AMERICAN SOCIETY FOR TESTING MATERIALS at the Chalfonte-Haddon Hall, Atlantic City, N. J. Secretary, C. L. Warwick, 1916 Race St., Philadelphia, Pa.

JUNE 23-27—Annual convention of the AMERICAN ELECTROPLATERS SOCIETY AND INDUSTRIAL FINISHING EXPOSITION in Detroit, Mich. For further information, address the Society at 93 Oak Grove Ave., Springfield, Mass.

JUNE 25—Annual meeting of the NATIONAL ASSOCIATION OF METAL FINISHERS, INC., in Detroit, Mich. Executive secretary, Raymond M. Shock, 2236-39 Dime Bldg., Detroit 26, Mich.

AUGUST 21-22—West Coast transportation and maintenance meeting of the SOCIETY OF AUTOMOTIVE ENGINEERS at the Biltmore Hotel, Los Angeles, Calif. Secretary and general manager, John A. C. Warner, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 1-4—Fall meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS at the Hotel Utah, Salt Lake City, Utah. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

SEPTEMBER 8-12—SECOND NATIONAL INSTRUMENT CONFERENCE AND INSTRUMENT EXHIBIT in Chicago, Ill., under the auspices of the Instrument Society of America. Further information can be obtained from T. W. Robinson, chairman of the Exhibit Committee, 236 N. Clark St., Chicago 1, Ill.

SEPTEMBER 17-26 — MACHINE TOOL SHOW in Chicago, Ill., under the auspices of the National Machine Tool Builders' Association, 10525 Carnegie Ave., Cleveland 6, Ohio.

OCTOBER 30 - NOVEMBER 1 — Semi-annual meeting of the AMERICAN SOCIETY OF TOOL ENGINEERS in Boston, Mass. Executive secretary, Harry E. Conrad, 1666 Penobscot Bldg., Detroit 26, Mich.

DECEMBER 1-5—Annual meeting of the AMERICAN SOCIETY OF MECHANICAL ENGINEERS in Atlantic City, N. J.; headquarters, Chalfonte-Haddon Hall. Secretary, Clarence E. Davies, 29 W. 39th St., New York 18, N. Y.

New Books and Publications

RESISTANCE WELDING MANUAL. 544 pages, 6 by 9 inches. Published by the Resistance Welder Manufacturers' Association, 505 Arch St., Philadelphia 6, Pa. Price, $3.

Considerable new material has been added in the revised edition of this welding manual, the size of the volume being practically double that of the first edition. In expanding the manual to its present size, the aim has been to make available to the metal fabricating industries a large part of the resistance welding knowledge which has been recently acquired through scientific research in order that plants may improve their practices and broaden the scope of their resistance welding applications. The text is arranged to present, in order, the fundamentals of resistance welding; the nature of the different resistance welding processes; the resistance welding characteristics of various important metal groups and their effect on welding procedures; recommended practices for resistance welding; mechanical and electrical characteristics of resistance welding machines; inspection, testing, and quality control; and recommendations for proper maintenance of equipment.

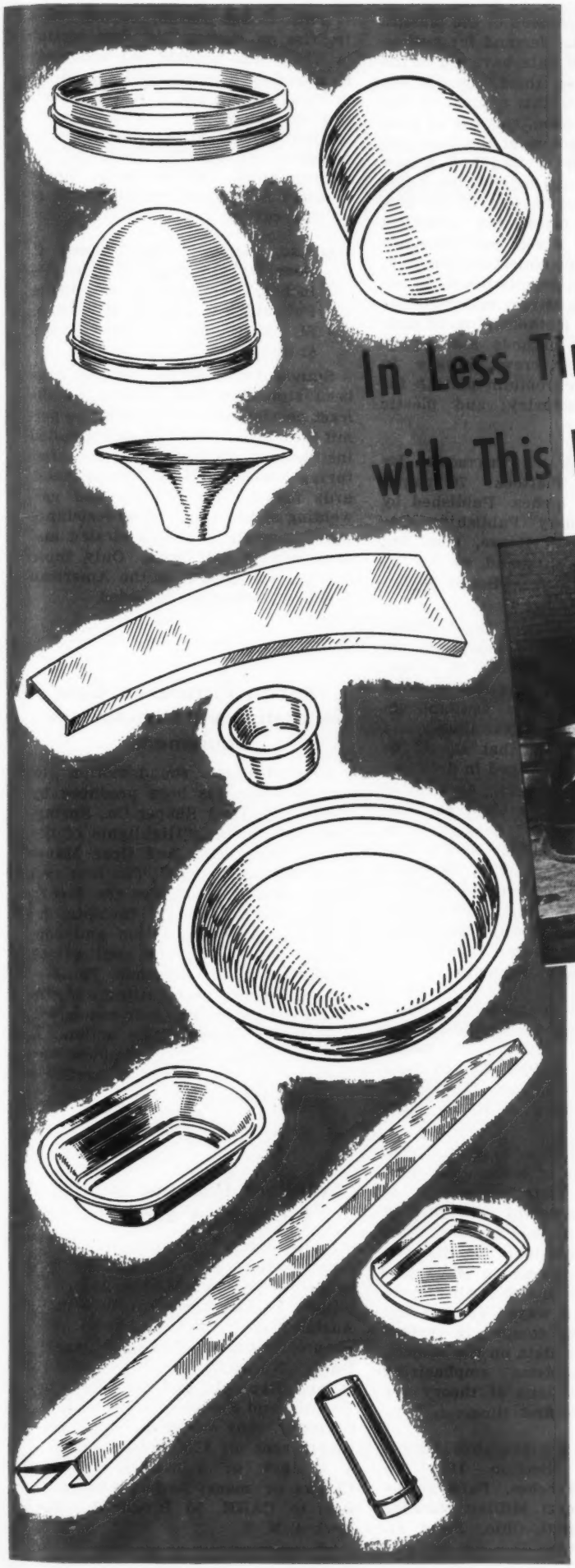
WORK MEASUREMENT MANUAL (Third Edition). By Ralph M. Barnes. 218 pages, 8 1/2 by 11 inches. Published by Wm. C. Brown Co., 973 Main St., Dubuque, Iowa. Price, $3.75.

This volume explains briefly the importance of time study; the procedure commonly used in making a time study; and the work measurement investigations now being conducted by Professor Barnes, and some of the preliminary findings. It tells how to conduct a community time-study survey and gives the results of two such surveys. This manual will serve as a guide for those interested in improving the ability of time-study men to set accurate and consistent time standards.

The book also contains a section on the use of standard motion-time data for operations performed on punch presses, hand screw machines, turret lathes, sensitive drills, and hand tappers. The final section of the book gives a full report, by companies, of an industrial engineering survey recently made by Professor Barnes. Eighty companies participated in this study.

MEASURING AND RATING EMPLOYE VALUE. By John B. Probst. 166 pages, 6 by 9 inches. Published by the Ronald Press Co., 15 E. 26th St., New York 10, N. Y. Price, $5.

This book has been written to meet the needs of those who are in search of thoroughly organized and time-tested methods of correctly rating the personnel and work performances of individual employes. It is based on the results of the author's research and his work in installing and operating plans during a long experience as personnel director and consultant in personnel relations. It discusses briefly the traditional methods of employe rating, and then proceeds to describe an improved rating sys-



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In Less Time with Lower Costs with This New Stamping Trimmer

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Handling almost any type of stamping in a single plane, Quickwork trimmers trim steel, stainless steel, and aluminum alloy stampings, with or without flash, with equal ease. Fixtures are especially adapted to the individual job as required, guiding even the most intricate stampings, throughout the entire pass.

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tem which employs the maximum application of scientific analysis and the minimum use of mere judgment. Different report forms for use with the procedures described are included, covering occupations in the fields of public administration, professions, skilled labor, unskilled labor, inspection, sales, clerical work, and education. Numerous examples of the actual applications of the methods are given.

FINISHES FOR ALUMINUM. Two volumes, 5 1/2 by 8 3/4 inches, 108 and 120 pages, respectively. Published by the Reynolds Metals Co., Inc., Department 27, 2500 S. Third St., Louisville 1, Ky. Price, $2.

These two volumes offer valuable detailed information on all of the better known commercial finishes for aluminum. The first book, contains data on eight cleaning treatments, seventeen mechanical surface finishes, fifteen chemical surface finishes, eleven electrolytic oxide treatments, twelve electroplated coatings, seven paint coatings, seven paint application methods, ceramic coatings (vitreous enamels), and special finishes, such as silk screen and sprayed metal finishes; it concludes with a discussion of various controls and tests for finishes. The second book supplements this information with shop data on materials, equipment, solution preparation, procedure, and control for more than thirty of the most widely used processes; it is bound in a loose-leaf form to permit the addition of revised bulletins, so that the information can be kept up to date.

MACHINE SHOP ESTIMATING. By W. A. Nordhoff. 486 pages, 5 1/4 by 8 1/4 inches. Published by the McGraw-Hill Book Co., Inc., 330 W. 42nd St., New York 18, N. Y. Price, $6.

A scientific basis for evaluating the performance of machine shop operators is presented in this new book on estimating. All the elements of operations performed in the average machine shop are listed, together with reasonable time values for their execution by the average operator. The different machine operations are fully described and various methods of estimating the time required to fabricate machined parts are explained. Sample estimates are shown for all machine operations. The material presented is the result of data collected from observations of men and machines at work over a period of approximately fifteen years.

PLASTICS MOLDS. By Gordon B. Thayer. 272 pages, 6 by 9 inches. Published by the Huebner Publications, 2460 Fairmount Blvd., Cleveland 6, Ohio. Price, $5.

The rapid expansion of the plastics industry and the demand for authoritative technical data have led to the publication of a third, greatly enlarged edition of this manual on the design, construction, and use of plastics molds. The text of the book has been thoroughly revised and a new chapter on estimating plastics molds is included. One chapter in the new edition enumerates 149 practical points in mold design and construction. Compression, injection, transfer, and jet molding are discussed. In addition, the book covers materials for plastics molds; methods of mold sink-ink; finishing methods and equipment; molding screw threads in plastics; hard chromium plating for the plastics industry; and plastic tooling.

JUNIOR DRAFTSMAN'S TEXTBOOK. By C. F. B. Shattock. 70 pages, 5½ by 8½ inches. Published by the Machinery Publishing Co., Ltd., National House, West St., Brighton 1, England, as No. 22 of the Yellow Back Series. Price, 3/6d.

This book introduces the beginner in draftsmanship to some of the methods employed. While it is not, of course, an exhaustive treatment of the subject, it makes available in compact form data on the theory and practice of drafting that should be of value to those engaged in drawing, as well as to beginners. An idea of the contents will be obtained from the following list of chapter headings: What is Draftsmanship?; The Draftsman's Tools; Tracing; Drawing and Design; Projection and Sectioning; Lettering and Figuring; Dimensioning; Limits and Fits; Materials; Engineering Processes; Detailing a Design; and Useful Formulas.

ELEMENTS OF MECHANISM. By Peter Schwamb, Allyne L. Merrill, and Walter H. James. 428 pages, 6 by 9 inches. Published by John Wiley & Sons, Inc., 440 Fourth Ave., New York 16, N. Y. Price, $4.

This is the sixth edition of a book on the elements of mechanism, first published over forty years ago. It gives the fundamental principles of kinematics in the field of mechanical movements. Principal machine elements are selected and a study presented of their motions when combined in certain ways. The present edition has been completely revised to include recent data on the subject. Laboratory problems emphasizing practical applications of theory are included for the first time.

A TREATISE ON MILLING AND MILLING MACHINES (Section II). 326 pages, 6 by 9 inches. Published by the Cincinnati Milling Machine Co., Cincinnati, Ohio. Price, $1.

This is the second section of a treatise on milling, the first section of which was brought out about ten months ago. The fundamentals of the milling process are covered in this section, including such factors as cutting speed, feed per tooth, amount of material removed, chip formation, surface finish, cutting fluids, power required in milling, and mounting of milling cutters.

WELDING SYMBOLS. By Vincent C. Gourley. 115 pages, 5½ by 8½ inches. Published by the Bruce Publishing Co., 540 N. Milwaukee St., Milwaukee 1, Wis. Price, $2.50.

Standard symbols for welding have been simplified and reduced to the least possible number in order to permit their use, without lengthy detailed instructions, on design and manufacturing drawings. The general standards for the use of arc- and gas-welding symbols, as well as resistance welding symbols, are illustrated and explained in this book. Only those symbols recognized by the American Welding Society are included.

* * *

Motion Picture on Gear Generating and Manufacturing Equipment

A 16-millimeter sound motion picture in color has been produced by the Fellows Gear Shaper Co., Springfield, Vt., entitled "Highlights of the Art of Generating and Gear Manufacturing Equipment." The first reel of the film demonstrates the theory and development of the involute, design of gear teeth, action and contact of gear teeth, and applications of the generating principle. The second reel shows gear cutting and finishing equipment and gear measuring and testing equipment in action. A bulletin containing a complete description of the picture is available from the company.

* * *

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CARE, the Cooperative for American Remittances to Europe, Inc., has expanded its service to the American people. Packages now can be sent to Austria, Belgium, Czechoslovakia, France, Finland, Greece, Hungary, Italy, Norway, the Netherlands, Poland, Rumania, and the American-, British-, and French-occupied zones of Germany. Any one of three packages can be sent for $10—a food package, a blanket, or a woolen package. Checks or money orders should be sent to CARE, 50 Broad St., New York 4, N. Y.

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Sizes — 24"— 30"— 36"

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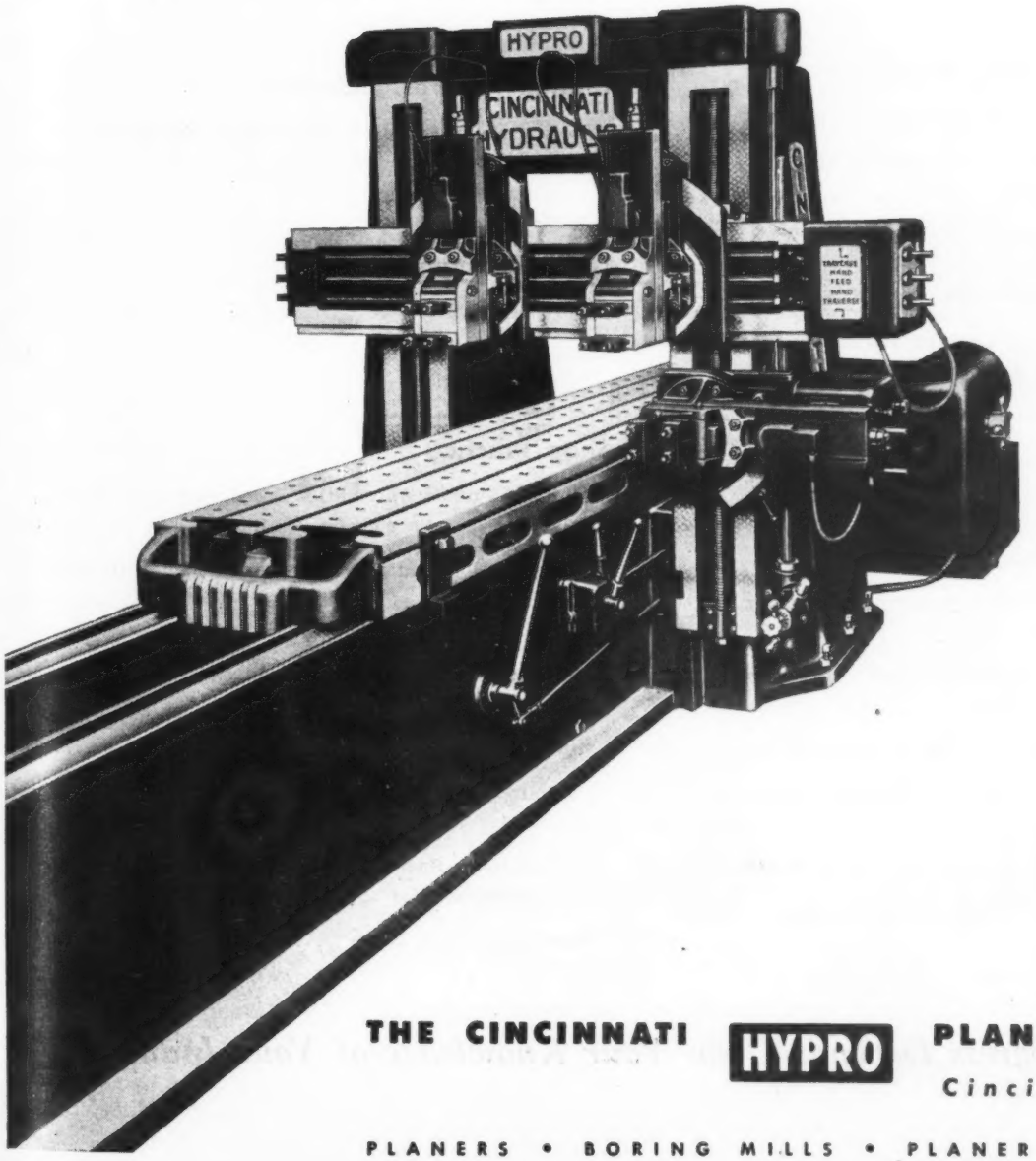

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Classified Contents

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